PB-239 494

# ANALYSIS MODELS FOR SOLID WASTE COLLECTION

## VOLUME II

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

PREPARED FOR
NATIONAL ENVIRONMENTAL RESEARCH CENTER

JANUARY 1975

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## TECHNICAL REPORT DATA

*(Please read Instructions on the reverse before compl*

**1. REPORT NO.**
EPA-670/2-75-026b

**2.**

**3.** PB 239 494

**4. TITLE AND SUBTITLE**
Analysis Models for Solid Waste Collection
Volume II

**5. REPORT DATE**
January 1975-Issuing Date

**6. PERFORMING ORGANIZATION CODE**

**7. AUTHOR(S)**
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**8. PERFORMING ORGANIZATION REPORT NO.**

**9. PERFORMING ORGANIZATION NAME AND ADDRESS**
Department of Civil Engineering
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**10. PROGRAM ELEMENT NO.**
1DB314;ROAP 02AAE;Task 03

**11. ~~CONTRACT~~/GRANT NO.**
801633

**12. SPONSORING AGENCY NAME AND ADDRESS**
National Environmental Research Center
Office of Research and Development
U.S. Environmental Protection Agency
Cincinnati, Ohio 45268

**13. TYPE OF REPORT AND PERIOD COVERED**

**14. SPONSORING AGENCY CODE**

**15. SUPPLEMENTARY NOTES**
See also "Analysis Models for Solid Waste Collection, Volume I," EPA-670/2-75-026a.

**16. ABSTRACT**

This report describes the research under the Environmental Protection Agency Contract, "Analysis Models for Solid Waste Collection" (801633). Analytic models are developed as aids in decision-making at many points in the solid waste collection and haul system. Models for daily operating policy include breakdown or excess load, maintenance and stochastic influences such as weather. Longer range issues include choosing a level of service and implications upon equipment, crew size, and work rules of such a decision. The primary thrust of the report develops an econometric model for prediction of waste output from census data and then districts into daily collection areas. A computer based districting methodology is outlined; an easily applicable heuristic for routing trucks within the districts was also developed. Actual data form Brookline, Massachusetts, serves in a sample application of the proposed models. Finally, on the regional level, a linear programming model for equitable and efficient system design has been realized. This second volume contains documentation of the computer programs used and developed in the course of the work as well as the appendices to the main volume.

**17. KEY WORDS AND DOCUMENT ANALYSIS**

| a. DESCRIPTORS | b. IDENTIFIERS/OPEN ENDED TERMS | c. COSATI Field/Group |
|---|---|---|
| Collection<br>Management<br>Computers<br>Refuse<br>Routes | Solid waste<br>Models routing<br>Solid waste management<br>Analytical models<br>Linear program | 13B |

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INFORMATION SERVICE
US Department of Commerce
Springfield, VA. 22151

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**18. DISTRIBUTION STATEMENT**
Release to Public

**19. SECURITY CLASS (This Report)**
Unclassified

**20. SECURITY CLASS (This page)**
Unclassified

**21. NO. OF PAGES**
225

**22. PRICE**
PC $7.25 / MF 2.25

EPA Form 2220-1 (9-73)

041021

EPA-670/2-75-026b
January 1975

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## Volume II

## Appendices and Documentation

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# FOREWORD

Man and his environment must be protected from the adverse effects of pesticides, radiation, noise and other forms of pollution, and the unwise management of solid waste. Efforts to protect the environment require a focus that recognizes the interplay between the components of our physical environment--air, water, and land. The National Environmental Research Centers provide this multidisciplinary focus through programs engaged in

- studies on the effects of environmental contaminants on man and the biosphere, and
- a search for ways to prevent contamination and to recycle valuable resources.

This second volume of "Analysis Models for Solid Waste Collection" contains the documentation of the computer programs developed and used in the course of the work and the appendices to Volume I. In Volume I, analytic models are developed as aids in decision-making at many points in the solid waste collection and haul system. All models are designed as management tools for public collection from residences and include discussion of appropriate extensions to commercial and industrial collection and haul.

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# ABSTRACT

This report describes the research under the Environmental Protection Agency Contract, "Analysis Models for Solid Waste Collection" (801633). Analytic models are developed as aids in decision-making at many points in the solid waste collection and haul system. Models for daily operating policy include breakdown or excess load, maintenance and stochastic influences such as weather. Longer range issues include choosing a level of service and implications upon equipment, crew size, and work rules of such a decision. The primary thrust of the report develops an econometric model for prediction of waste output from census data and then districts into daily collection areas. A computer based districting methodology is outlined; an easily applicable heuristic for routing trucks within the districts was also developed. Actual data from Brookline, Massachusetts, serves in a sample application of the proposed models. Finally, on the regional level, a linear programming model for equitable and efficient system design has been realized.

All models are designed as management tools for public collection from residences and include discussion of appropriate extensions to commercial and industrial collection and haul.

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# ACKNOWLEDGEMENTS

This work was supported financially by the Solid Waste Research Laboratory, U.S. Environmental Protection Agency under grant number 801633. Administrative support was provided by the M.I.T. Department of Sponsored Research under DSR numbers 73421 and 80572.

This work was performed by Dr. David H. Marks, Principal Investigator and Associate Professor of Civil Engineering, and by James F. Hudson, Donald S. Grossman, and Louis A. Fuertes, Research Assistants in Civil Engineering Systems. The authors of this final report would like to express their thanks to Mr. Fuertes for his work during the first year of the research, primarily on the Regional Processing, Haul and Disposal Model.

The authors gratefully acknowledge the assistance in data gathering provided by various individuals in the Brookline Department of Public Works, the Raytheon Service Company, UNITEL, and Boeing Computer Services. We would also like to thank Chris Ungate, Herman Kwai, and B.A.A.N. Akonteh for their assistance in the research.

Special thanks are reserved for Pat Dixon and Erika Babcock for their patience and skill in preparing the report, and for Donald Oberacker, the EPA Project officer involved in supervising the research.

# I. Introduction

This is the second of two volumes in the final report for the contract "Analysis Models for Solid Waste Collection," funded for two years by the U.S. Environmental Protection Agency (Contract 801635). The main report is contained in Volume I, with this second volume containing the documentation for the computer models used and the Appendices.

As such, it is probably not of interest to the general reader. It may, though, be of value to those considering the application of one or more of the techniques discussed in the previous volume, so it has been compiled. It seems a natural trend in universities that research is often left undocumented, except for a few brief paragraphs in a well-hidden thesis. Since it is our contention that analytical models can be of value in real world applications, we have at very least attempted to give listings for the various computer programs used and some idea of how to use them. While none of the programs is in final form, or in any sense marketable, these descriptions and listings may aid potential users or other researchers in their work. This, we feel, is sufficient justification for volume II.

Most of the programs described are written in standard FORTRAN or in the IBM Mathematical Programming System MPSX, although one is in GPSS/360. The references at the end of the volume contain information on the relevant manuals for these languages. Listings are given for most programs, with variable definitions following. All programs except the Iowa Redistricting System will be available through the authors until three years after publication (at least), and are in the public domain.

## II. The Political Districting Problem

The districting problem is a multiobjective one, and has not been well defined for easy formulation. There are two real objectives - minimum population variance and compactness of districts - without any clear trade-off defined between them (contiguity of districts is a constraint). Since there is also no universal analytical measure for compactness, most formulations use different measures and are not directly comparable. The only optimal districting algorithm is that of Garfinkle and Nemhauser who formulate it as a set covering problem. Suppose there are N units to be formed into M districts, N>>M. These units are formed into a set of feasible districts from which the optimal set is to be chosen. Then

$$\text{Min } (\text{Max } \sum_j C_j x_j)$$

$$\text{s.t. } \sum_j a_{ij} x_j = 1 \qquad i = 1, \ldots., N$$

$$\sum_j x_j = M$$

$$x_j = 0,1$$

where $x_j$ = 1 if district j is in the optimal plan

= 0 if not

M = number of districts to be in the plan

N = number of population units

$C_j = \frac{|P(j)-\bar{p}|}{\alpha\bar{p}}$ (population variance)

$a_{ij}$ = 1 if the ith subdistrict is in the jth district

= 0 if not

For this optimization procedure to be used, however, it is necessary to generate the set of $a_{ij}$'s - the list of which population units are contained in any potential district. To do this, every feasible district must be enumerated and the $a_{ij}$'s computed. A feasible district is defined as any group of units which meets tests on compactness, contiguity and population variance. Obviously, the definition of "feasible" is crucial, and is very dependent on the data base. Choice of measures should probably be made in the actual application.

The IOWA system is much less elegant, and clearly does not lead to an optimal solution. In building a district, population units are jointed on a "closest first" basis, which is essentially the compactness measure

$$\text{Min}\ (\max d_{ij})$$

where $d_{ij}$ is the distance between two units in the district. When the district passes the desired size, units are removed to bring the population as close to that desired as possible. The main weakness is that there is no interaction between districts in the process, that there is no way to trade units between completed districts to improve them. The first districts tend to be very compact, and later ones less so, since the region of unassigned districts becomes less compact.

## III. The Iowa Redistricting System

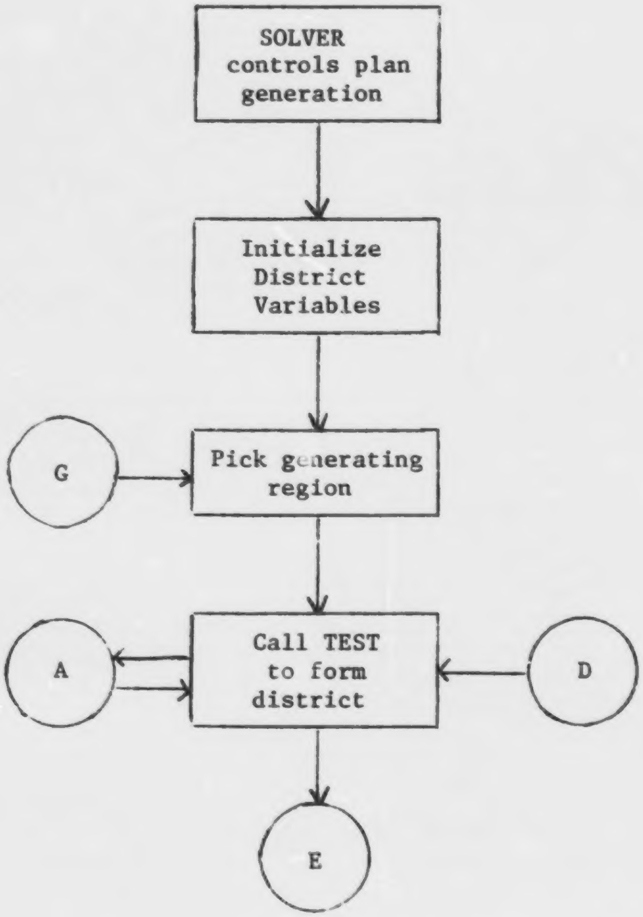
REDIST, the central program of the Iowa Redistricting System, is available from

Professor J.M. Liittschwager
University of Iowa
Iowa City, Iowa.

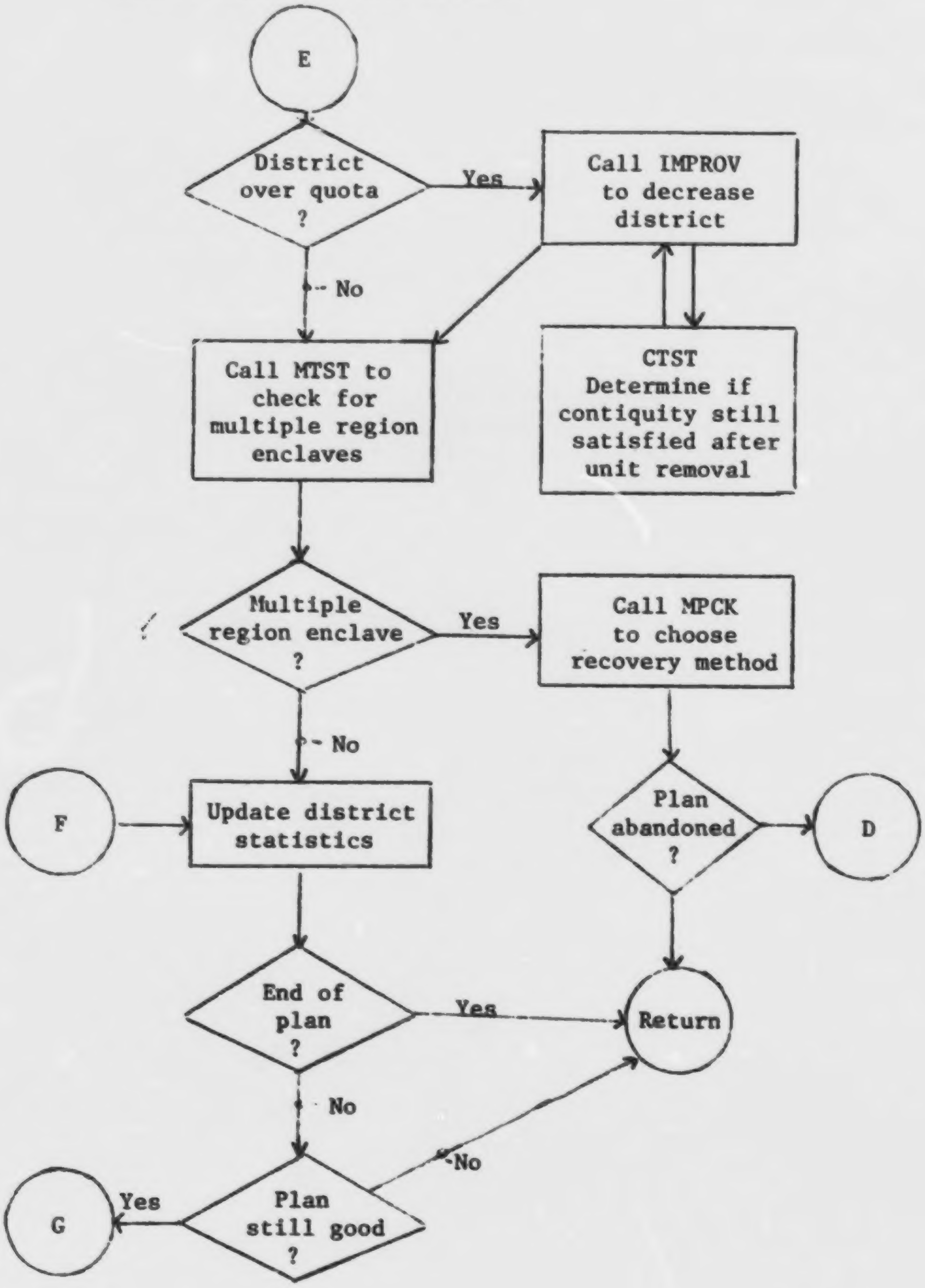
The system is available only for not-for-profit applications. We have included here listings of the first pages of the major subroutines of REDIST, to give a basic understanding of the interactions between these key routines. Simplified Flow Diagrams of the structure have also been included. After the listings, a description is given of the data requirements and the use of REDIST. For a detailed description of the system and its application to redistricting problems, see

> Liittschwager, J.M. "The Iowa Redistricitng System," Presented at the 40th National ORSA meeting, Anaheim, California, October 27-29, 1971.

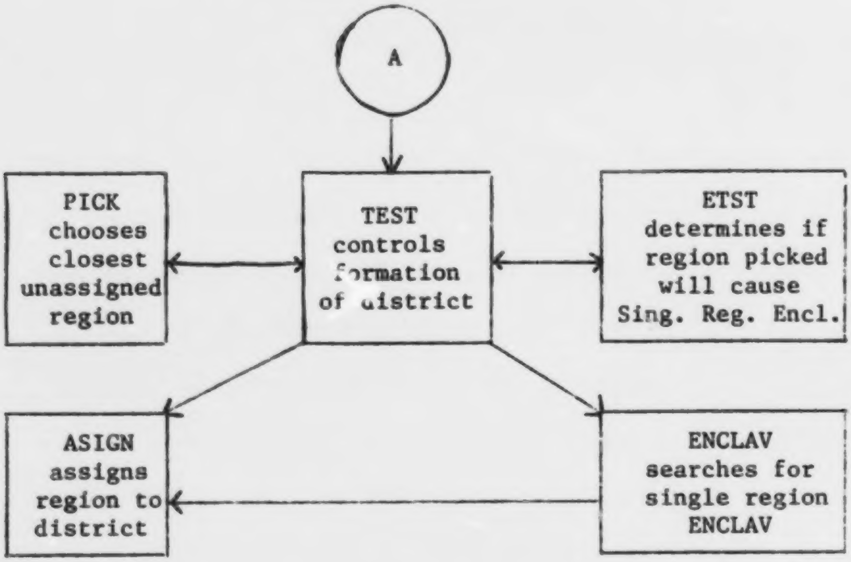
## REDIST PROGRAM - SIMPLIFIED FLOW DIAGRAM


SOLVER controls plan generation
Initialize District Variables
G
Pick generating region
A
Call TEST to form district
D
E

REDIST PROGRAM - FLOW DIAGRAM


E
District over quota ?
Yes
Call IMPROV to decrease district
No
CTST Determine if contiquity still satisfied after unit removal
Call MTST to check for multiple region enclaves
Multiple region enclave ?
Yes
Call MPCK to choose recovery method
No
F
Update district statistics
Plan abandoned ?
D
End of plan ?
Yes
Return
No
No
Yes
G
Plan still good ?

## REDIST PROGRAM


A
PICK chooses closest unassigned region
TEST controls formation of district
ETST determines if region picked will cause Sing. Reg. Encl.
ASIGN assigns region to district
ENCLAV searches for single region ENCLAV

## SUBROUTINES CALLED FREQUENTLY

| Name | Called By | Function |
|---|---|---|
| LOOKUP | CTST, ENCLAV, ETST, IMPROV, MTST, PICK | Returns the contiguity list for a requested region |
| DISTAN | MAIN, MPCK, MTST, SOLVER | Computes distances to regions from a given region, and stores them in the array dist.<br>Returns the nearest and furtherest region from this point |

```
C***********************************************************************
C*                                                                     *
C*                 REDIST                                              *
C*                 THE MAIN REDISTRICTING PROGRAM                      *
C*                                                                     *
C*   A PART OF THE IOWA REDISTRICTING SYSTEM                           *
C*                                                                     *
C*   WRITTEN BY    WILLIAM R. PRINGLE                                  *
C*                 UNIV. COMPUTER CTR.                                 *
C*                 UNIVERSITY OF IOWA                                  *
C*                                                                     *
C*                                                                     *
C*   WRITTEN FOR   JOHN LIITTSCHWAGER                                  *
C*                 DEPT. OF IND. ENG.                                  *
C*                 UNIVERSITY OF IOWA                                  *
C*                                                                     *
C*                                                                     *
C*   THE ORIGIONAL VERSION OF THIS PROGRAM WAS WRITTEN BY              *
C*                 BURTON C. GEARHART                                  *
C*                                                                     *
C*                                                                     *
C***********************************************************************
C
C
C                                                                       MAIN0010
C                                                                       MAIN0260
C         GLOBAL VARIABLES                                              MAIN0270
C                                                                       MAIN0280
      INTEGER*2  KSIGN,NUM
C
      COMMON        DIST(500),IAVE,ICHUZ,IPOP(500),IQUOTA,MARK,
     *              NAME(500,3),NBER,NDIST,NTDIST,NTOT,NTOTAL(150),
     *              SUM,X(505),Y(505),NFR,IDENT(500),KSIGN(500),NUM(150)
C
      INTEGER*2  ICONT,ICONTL
C
```

```
      COMMON /CONT/ ICONT(2500),ICONTL(500)
C
      LOGICAL*1 $SIGN                                                   MAIN
C                                                                       MAIN
      COMMON/SOLV/  IKODE,IPICK,NTSIGN,NLEFT,IPJNCH,ITOT,               MAIN
     *              IFCONT,$SIGN(150)                                   MAIN
C                                                                       MAIN
C                                                                       MAIN0360
C        LOCAL VARIABLES                                                MAIN0370
C                                                                       MAIN0380
      DIMENSION TITLE(8)                                                MAIN0390
      LOGICAL $ICHUZ
      INTEGER*2 IONE(13)
C
C             PROGRAM LIMIT VARIABLES
C
      DATA KDIST / 150 /,KREG / 500 /, KMEM / 150/
C
C              *********  STOP CODES   **********
C
C    CODE    ROUTINE      REASON
C      69    ASIGN        REGION THAT WAS TO BE ASSIGNED WAS ALREADY
C                         ASSIGNED.
C     169    SOLVER       DISTRICT NUMBER OF THE NEXT DISTRICT TO BE
C                         FORMED EXCEEDED THE TOTAL NUMBER OF DISTRICTS.
C     269    MAIN         MORE REGIONS THAN THE PROGRAM COULD HANDLE WAS
C                         REQUESTED TO BE READ IN.
C
C        ******************************************************
C                                                                       MAIN0400
C        GET NUMBER OF INPUT REGIONS OR DATA SET REFERENCE              MAIN0410
C        NUMBER IF INPUT IS FROM TAPE                                   MAIN0420
C                                                                       MAIN0430
C        IF 'INPUT' IS NON-ZERO THEN IT IS THE FORTRAN UNIT             MAIN0440
C        NUMBER FOR THE INPUT TAPE                                      MAIN0450
C                                                                       MAIN0460
```

```
C         IF 'INPUT' IS LEFT BLANK THEN INPUT IS ASSUMED                 MAIN0470
C         TO BE FROM THE CARD READER                                     MAIN0480
C                                                                        MAIN0490
 1    READ (5,9000,END=559) INPUT,NTOT                                   MAIN0500
 9000 FORMAT(2I5)                                                        MAIN0520
C                                                                        MAIN0530
C          ECHO-CHECK INPUT CARD & STATE LIMITS OF PROGRAM               MAIN0540
C                                                                        MAIN0550
      WRITE(6,9050) NTOT,INPUT,KREG,KDIST,KMEM                           MAIN0560
 9050 FORMAT(I10,' REGIONS TO BE READ FROM UNIT',I3/                     MAIN0570
     *        I10,' MAXIMUM NO. OF REGIONS'         /
     *        I10,' MAXIMUM NO. OF DISTRICTS'       /
     *        I10,' MAXIMUM NO. OF MEMBERS / DISTRICT')
      IF (NTOT.GT.KREG) STOP 269
C                                                                        MAIN0580
C         SEE IF INPUT IS TO BE FROM TAPE OR THE CARD READER             MAIN0590
C                                                                        MAIN0600
      IF (INPUT.EQ.0) INPUT = 5                                          MAIN0610
C                                                                        MAIN0620
C         GET THE EXTERNAL ID NUMBER, X COORDINATE,                      MAIN0630
C         Y COORDINATE, POPULATION, AND NAME FOR ALL INPUT               MAIN0640
C         REGIONS                                                        MAIN0650
 3    READ (INPUT,9001) (IDENT(I),X(I),Y(I),IPOP(I),                     MAIN0660
     .(NAME(I,J),J=1,3),I=1,NTOT)                                        MAIN0670
 9001 FORMAT(4X,I9,2F7.2,I7,T50,3A4)
C          INITIALIZE MAX & MIN VALUES FOR X & Y
C
      XMAX = -10.E74
      XMIN = +10.E74
      YMAX = XMAX
      YMIN = XMIN
C
C          INITIALIZE TOTAL POPULATION
C
      ISUM = 0
C
```

```
C           LOOP THRU REGIONS
C           TO GET TOTAL POPULATION &
C           CONTINGUTY LISTS, &
C           MAX & MIN VALUES FOR
C           X & Y
C
      DO 4 I=1,NTOT                                                     MAIN0710
      ISUM = ISUM+IPOP(I)                                               MAIN0720
C                                                                       MAIN0730
C        GET CONTIGUITY MATRIX
C                                                                       MAIN0750
      READ (INPUT,9002) IONE
 9002 FORMAT (13I5)                                                     MAIN0770
C
      CALL WRIT (I,IONE)
C
C
      XM=X(I)
      IF(XMAX.LT.XM) XMAX = XM
      IF(XMIN.GT.XM) XMIN = XM
C
      YM = Y(I)
      IF (YMAX.LT.YM) YMAX=YM
      IF(YMIN.GT.YM)YMIN = YM
    4 CONTINUE                                                          MAIN0780
C                                                                       MAIN0800
      SUM = ISUM                                                        MAIN0810
C                                                                       MAIN1720
C        PROCESSING OF FOUR PSEUDO STARTING CODES WHEN                  MAIN1730
C        ICHUZ=3                                                        MAIN1740
C                                                                       MAIN1750
C          ALSO FOR MULTIPLE ENCLAVE RECOVERY METHOD 3                  MAIN1760
C                                                                       MAIN1770
      XDIF = XMAX-XMIN                                                  MAIN1800
      YDIF = YMAX-YMIN                                                  MAIN1830
      X(NTOT+1) = XMIN+XDIF/2.0                                         MAIN1840
      Y(NTOT+1) = YMAX+YDIF*5.0                                         MAIN1850
      X(NTOT+2) = XMAX+XDIF*5.0                                         MAIN1860
      Y(NTOT+2) = YMIN+YDIF/2.0                                         MAIN1870
      X(NTOT+3) = X(NTOT+1)                                             MAIN1880
      Y(NTOT+3) = YMIN-YDIF*5.0                                         MAIN1890
      X(NTOT+4) = XMIN-XDIF*5.0                                         MAIN1900
      Y(NTOT+4) = Y(NTOT+2)                                             MAIN1910
C                                                                       MAIN0820
C                                                                       MAIN0830
C        GET PARAMETER CARD FOR OPTIONS                                 MAIN0840
C                                                                       MAIN0850
    5 READ (5,9003,END=559) IPUNCH,NDIST,ICHUZ,IFREDO,
     *       IPICK,RATIO,NFR,IFCONT,ILIST,INC,IKODE,
     *       X(NTOT+5),Y(NTOT+5),(TITLE(I),I=1,8)
 9003 FORMAT(I1,I4,T10,2I1,I4,F5.3,I4,2I1,I3,T30,I1,2F10.2,(7A4,A2))
C                                                                       MAIN0900
C        PARAMETER CARD FORMAT                                          MAIN0910
C                                                                       MAIN0920
C                                                                       MAIN0930
C        COLS.   NAME     CONTENTS                                      MAIN0940
C        ---------------------------------------------------            MAIN0950
C        1     I IPUNCH I ZERO  IF PUNCHED OUTPUT OF A                  MAIN0960
C              I        I PLAN IS NOT WANTED.                           MAIN0970
C              I        I NON-ZERO  IF PUNCHED OUTPUT OF A              MAIN0980
C              I        I PLAN IS WANTED AND ICHUZ=2.                   MAIN0990
C              I        I 9 IF NEW PROBLEM TO BE READ.
C        2 - 5 I NDIST  I TOTAL NUMBER OF MEMBERS TO BE                 MAIN1000
C              I        I SEATED.                                       MAIN1010
C        6 - 9 I ------ I BLANK                                         MAIN1020
C        10    I ICHUZ  I =1 FOR RANDOM STARTING REFERENCE              MAIN1030
C              I        I REGION.                                       MAIN1040
C              I        I =2 FOR REFERENCE REGION SPECIFIED             MAIN1050
C              I        I BY IPICK AND/OR IKODE.                        MAIN1060
C              I        I =3 FOR ALL STARTING CODES BEGINNING WITH      MAIN1070
C              I        I REGION 'IPICK' AND INCREMENTING BY 'INC',
C              I        I PLUS FOUR PSEUDO STARTING CODES.              MAIN1080
```

```
C        11    I IFREDO I ZERO  IF ALL DISTRICTS TO BE GENERATED
C              I        I NON-ZERO IF PLAN IS A REDO
C              I        I WHICH IMPLIES THAT FOLLOWING PARAMETER CARD
C              I        I IS A REDO CONTROL CARD AND THE NECASSARY
C              I        I OTHER CARDS FOR REDO
      CONTINUE
C        12-15 I IPICK  I REFERENCE REGION WHEN ICHUZ=2.                 MAIN1100
C              I        I IF ICHUZ=3 THEN FIRST REFERENCE REGION
C              I        I (IF ICHUZ=3 AND IPICK=0 THEN 1 IS ASSUMED)
C        16-20 I RATIO  I MAXIMUM ALLOWABLE POPULATION RATIO
C              I        I (IF ZERO, RATIO IS ASSUMED TO BE 1.500)
C        21-24 I NFR    I NUMBER OF FORCED REGIONS.                      MAIN1120
C              I        I IF ICHUZ=2 & NFR .GT. 0 THEN FOLLOWING         MAIN1130
C              I        I REDO CARDS (IF USED) OR PARAMETER
C              I        I CARD IS 'NFR' CARDS
C              I        I WITH FORCED REGION NUMBERS (I5 FORMAT)         MAIN1150
C        25    I IFCONT I ZERO  IF DISTRICT CONTIGUITY TO BE CHECKED
C        26    I ILIST  I NON-ZERO  IF AREAS ARE TO BE LISTED            MAIN1180
C        27-29 I INC    I VALID FOR ICHUZ=3 ONLY. INCREMENT FOR
C              I        I STARTING REGIONS. (IF ZERO, 1 IS ASSUMED.)
C        30    I IKODE  I BLANK IF NO PSEUDO REFERENCE                   MAIN1190
C              I        I REGION IS DESIRED.                             MAIN1200
C              I        I 1 IF FORCED REGIONS ARE TO BE USED             MAIN1210
C              I        I 2 IF FIRST DISTRICT IS FORMED                  MAIN1220
C              I        I AROUND REGION CLOSEST TO THE                   MAIN1230
C              I        I PSEUDO REGION AND DISTANCES ARE                MAIN1240
C              I        I CALCULATED RELATIVE TO THE PSEUDO              MAIN1250
C              I        I REGION.                                        MAIN1260
C              I        I IF IKODE IS SPECIFIED IT IS USED               MAIN1270
C              I        I THE FORMATION OF THE FIRST SINGLE              MAIN1280
C              I        I MEMBER DISTRICT, ALL ADDITIONAL                MAIN1290
C              I        I DISTRICTS ARE FORMED USING IPICK               MAIN1300
C              I        I AS THE REFERENCE REGION.  IKODE IS             MAIN1310
C              I        I VALID ONLY WHEN ICHUZ=2.                       MAIN1320
      CONTINUE
C        31-40 I X      I X COORDINATE OF THE PSEUDO REGION              MAIN1330
```

```
C           I          I WHEN IKODE>NTOT
C     41-50 I Y        I Y COORDINATE THE PSEUDO REGION               MAIN1350
C           I          I WHEN IKODE>NTOT
C     51-80 I TITLE    I TITLE OF PLAN TO APPEAR ON THE               MAIN1370
C           I          I TITLE PAGE.                                  MAIN1380
C     ------------------------------------------------------          MAIN1390
C                                                                     MAIN1400
C                                                                     MAIN1410
C     CHECK FOR LAST PARAMETER CARD OF THE SET                        MAIN1420
C                                                                     MAIN1430
      IF (IPUNCH.EQ.9)  GO TO 1                                       MAIN1440
C
C             SEE IF REGIONS ARE TO BE LISTED
C
      IF (ILIST.NE.0) CALL LIST(ILIST)
C
C             ECHO CHECK PARAMETER CARD
C
      WRITE (6,9004) (TITLE(I),I=1,8)                                 MAIN1500
 9004 FORMAT (1H1,////,25X,28HLEGISLATIVE DISTRICTING FOR  ,          MAIN1510
     .7A4,A2)                                                         MAIN1520
C             DEFAULT VALUES                                          MAIN1490
      IF (RATIO.LE.0.0) RATIO = 1.5
      IF (INC.EQ.0) INC = 1
      IF (ICHUZ.NE.2) IKODE = 0
      IF (ICHUZ.NE.3) INC   = 0
      IF (ICHUZ.EQ.3 .AND. IPICK.EQ.0)  IPICK=1
      IF (IKODE.NE.1) NER   = 0
C     IF (ICHUZ.EQ.3) IPUNCH= 0
      WRITE (6,4000) IPUNCH,NDIST,ICHUZ,IFREDO,IPICK,NER,IFCONT,
     *        IKODE,X(NTOT+5),Y(NTOT+5),RATIO,INC
 4000 FORMAT(//1X,'PUNCH=',I1,', NDIST=',I4,', ICHUZ=',I1,', REDO=',I1/
     *     ' IPICK=',I4,', FORCED REGS=',I4,', CONT=',I1/
     *     ' IKODE=',I1,', X=',F10.2,', Y=',F10.2/
     *      ' RATIO=',F11.5,', INC=',I4)
C                                                                     MAIN1450
```

```
C          CHECK FOR IMPROPER DECK SET-UP                                MAIN1460
C                                                                        MAIN1470
      IF (NDIST.LT.1 .OR. NDIST.GT.KDIST) GO TO 200
      IF (ICHUZ.LT.1 .OR. ICHUZ.GT.3) GO TO 200                          MAIN1480
      IF (ICHUZ.GT.1 .AND. (IPICK.LT.1 .OR. IPICK.GT.NTOT)) GO TO 200
      IF (IKODE.LT.0 .OR. IKODE.GT.2) GO TO 200                          MAIN2260
      IF (NFR.LT.0 .OR. NFR.GT.NDIST) GO TO 200                          MAIN2280
      IF(IPUNCH.NE.0) WRITE(7,3000) NDIST,TITLE
 3000 FORMAT('********** BEGIN ',T20,I5,' DISTRICTS.',T51,7A4,A2)        MAIN1530
C
      KOUNT = 0                                                          MAIN1550
      NTDIST = NDIST+1                                                   MAIN1570
      IPSUDO = 0
      $ICHUZ = .FALSE.
      IF (IFREDO.NE.0) CALL REDO (ISUM)
C
C
C ***********************************************************************
C                                                                        MAIN1580
C                                                                        MAIN1590
C          RETURN POINT FOR EACH PLAN WHEN ICHUZ=3                       MAIN1600
C                                                                        MAIN1610
    6 CONTINUE
      CUR = RATIO
      IF (IFREDO.NE.0) GO TO 20                                          MAIN1630
      DO 7 I=1,NTOT
      IF (I.LT.NTDIST)$SIGN(I) = .FALSE.                                 MAIN1640
    7 KSIGN(I) = 0                                                       MAIN1660
      NTSIGN = ISUM                                                      MAIN1670
      NLEFT = ISUM
   20 CONTINUE
C
C              SEE IF ALL DISTRICTS WERE ASSIGNED IN REDO
C
      IF (NDIST.EQ.0) GO TO 5                                            MAIN1680
C
```

```
C                                                                       MAIN1690
C         COMPUTE THE IDEAL AVERAGE POPULATION/MEMBER                   MAIN1700
C                                                                       MAIN1710
      IAVE = NTSIGN/NDIST                                               MAIN1920
      IF (ICHUZ.EQ.3.AND.IPICK.GT.1)  GO TO 9
      WRITE (6,9005) NLEFT,NDIST,IAVE                                   MAIN1940
 9005 FORMAT (1H0,18HTOTAL POPULATION = ,I8/1X,                         MAIN1950
     .17HNUMBER OF MEMBERS,15X,1H=,I8/1X,15HAVERAGE POPULAT,            MAIN1960
     .18HION PER MEMBER    =,I8//)
      IF (ICHUZ.EQ.3) GO TO 10                                          MAIN2060
      GO TO 8                                                           MAIN2080
C
C
    9 CONTINUE
C
C         SEE IF REDO UNDER ICHUZ = 3 NEEDED
C
      IF($ICHUZ.OR.IFREDO.EQ.0) GO TO 10
C
C         ICHUZ = 3 ON REDO
C
C         FIRST TIME, RESET KSIGN
C
      CALL REDONE (ISUM)
C
C         SO THAT WE DON'T RECALL
C         BEFORE NEXT PLAN
C
      $ICHUZ = .TRUE.
C
C         CHECK FOR IPICK ASSIGNED
C
   10 IF(KSIGN(IPICK).NE.0) GO TO 18
C
C         NEXT STARTING POINT FOUND
C         RESET ICHUZ FLAG
C
```

```
      $ICHUZ = .FALSE.
      KOUNT = KOUNT+1                                                   MAIN2910
      IF (MOD(KOUNT,50).EQ.1)  WRITE (6,9006)
 9006 FORMAT('1',T17,'DISTRICT STATISTICS'                              MAIN2030
     *   /   'OSTARTING',T15,'CODE',T23,'POPULATION',T36,'P. V.',       MAIN2040
     *   T44,'SUM OF DEV',T60,'TOTAL NO.'                               MAIN2050
     *   /    ' REGION',T16,'NO.',T24,'REMAINING',T36,'RATIO',
     *   T45,'FROM MEAN',T60,'MULT. ENCL.'  /)
 9    KKK = NDIST                                                       MAIN2090
      IF (ICHUZ-2)  12,13,14                                            MAIN2100
C                                                                       MAIN2110
C        OBTAIN A UNIFORM 1-NTOT RANDOM NUMBER FOR USE AS               MAIN2120
C        THE INITIAL REFERENCE REGION                                   MAIN2130
C                                                                       MAIN2140
 12   IPICK = NTOT*RANDNO(1)+1.0                                        MAIN2150
   13 WRITE(6,9008) (NAME(IPICK,J),J=1,3),IDENT(IPICK),
     *        X(IPICK),Y(IPICK),IPOP(IPICK)
 9008 FORMAT(// 1X,3A4,'  STARTING REGION. CODE NO.=',I10,
     *        '  X = ',F10.2,'  Y = ',F10.2,'  POP = ',I10/'1')
C                                                                       MAIN2220
C                                                                       MAIN2240
   14 CONTINUE
C                                                                       MAIN2290
C     . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . MAIN2300
C
C                          **** FORM DISTRICT ****
C
C                                                                       MAIN2310
      CALL SOLVER (CUR)
C                                                                       MAIN2330
C           CHECK FOR ABANDONED PLAN                                    MAIN2340
C                                                                       MAIN2350
      IF (MARK.NE.0) GO TO 100                                          MAIN2360
C                                                                       MAIN2370
C           PLAN ABANDONED, READ EXCESS FORCED REGION CARDS             MAIN2380
C                                                                       MAIN2390
```

```
   90 IF (NFR.LE.0) GO TO 95                                            MAIN2400
C                                                                       MAIN2410
      READ (5,1000)                                                     MAIN2420
 1000 FORMAT(1X)                                                        MAIN2430
C                                                                       MAIN2440
      NFR = NFR -1                                                      MAIN2450
      GO TO 90                                                          MAIN2460
C                                                                       MAIN2470
   95 CONTINUE                                                          MAIN2480
C                                                                       MAIN2490
C           PLAN ABANDONED. START NEW PLAN                              MAIN2500
C                                                                       MAIN2510
      NDIST = NTDIST-1                                                  MAIN2520
      IF (ICHUZ.NE.3) GO TO 5                                           MAIN2530
      GO TO 15                                                          MAIN2540
C                                                                       MAIN2550
C           PLAN O.K.   CONTINUE PROCESSING                             MAIN2560
C                                                                       MAIN2570
  100 CONTINUE                                                          MAIN2580
C                                                                       MAIN2590
C                                                                       MAIN2600
      NDIST = NTDIST-1                                                  MAIN2610
      IF (ICHUZ.NE.3.AND.NLEFT.NE.0)  WRITE [illegible]9009)            MAIN2620
 9009 FORMAT (1H0,10X,30HENCLAVE DETECTED IN THIS PLAN.)                MAIN2630
C                                                                       MAIN2640
C          GATHER STATISTICS FOR THE COMPLETED PLAN.                    MAIN2650
C                                                                       MAIN2660
      INDEX = IDENT(IPICK)                                              MAIN2670
C**************
C     CALL STAT (KKK,INDEX,NLEFT,RATIO)
C**************
      IF (ICHUZ.EQ.3)  GO TO 15                                         MAIN2690
      IF (NLEFT.EQ.0)  GO TO 5                                          MAIN2760
C                                                                       MAIN2770
C          PRINT REGIONS UNABLE TO BE ASSIGNED                          MAIN2780
C                                                                       MAIN2790
```

```
                                                                  MAIN2800
      WRITE (6,9011)                                              MAIN2810
 9011 FORMAT (1H1,16X,29HREGIONS UNABLE TO BE ASSIGNED//1X,
     *       'CODE NO.',2X,'NAME',9X,'POPULATION',6X,'X',11X,'Y',11X,  MAIN2830
     *       'SEQ. NO.')                                          MAIN2840
      DO 16 IADD=1,NTOT                                           MAIN2850
      IF (KSIGN(IADD).GT.0)  GO TO 16                             MAIN2860
      WRITE (6,9012) IDENT(IADD),(NAME(IADD,J),J=1,3),
     .IPOP(IADD),X(IADD),Y(IADD),IADD                             MAIN2880
 9012 FORMAT ( I11 ,3X,3A4,2X,I10,2X,F10.3,2X,F10.3,2X,I10)       MAIN2890
 16   CONTINUE
      GO TO 5                                                     MAIN2920
   15 CONTINUE                                                    MAIN2930
   18 IPICK = IPICK + INC                                         MAIN2940
      IF (IPICK.LE.NTOT.AND.IPSUDO.EQ.0)  GO TO 6                 MAIN2950
      IF (IPSUDO.GE.4)  GO TO 5                                   MAIN2960
 17   IPSUDO = IPSUDO+1                                           MAIN2970
      IKODE = NTOT+IPSUDO                                         MAIN2980
      CALL DISTAN (IKODE,1,IPICK,MINI)                            MAIN2990
      WRITE (6,9014) IKODE,X(NTOT+IPSUDO),Y(NTOT+IPSUDO),         MAIN3000
     .IPICK                                                       MAIN3010
 9014 FORMAT (1H ,8HIKODE = ,I4,6H, X = ,F10.2,6H, Y = ,          MAIN3020
     .F10.2,10H, IPICK = ,I4)
      GO TO 6                                                     MAIN3050
  559 STOP 1                                                      MAIN3060
C                                                                 MAIN3070
  200 CONTINUE                                                    MAIN3080
C                                                                 MAIN3090
C            IMPROPER DECK SET-UP .. SKIP CARD                    MAIN3100
C                                                                 MAIN3110
      WRITE(6,2000)                                               MAIN3120
 2000 FORMAT('0******   INVALID  DECK  SET-UP   . . .   SKIPPING TO ',  MAIN3130
     *       'NEXT CARD   ******')                                MAIN3140
      GO TO  5
      END
      SUBROUTINE ASIGN (IADD,J1,NLEFT,ITOT,KDIFF)                       ASIG0010
C                                                                       ASIG0020
C                                                                       ASIG0030
C     . . . . . . . . . . . . . . . . . . . . . . . . . .               ASIG0040
C                                                                       ASIG0050
C                                                                       ASIG0060
C        PURPOSE                                                        ASIG0070
C                                                                       ASIG0080
C        TO ASSIGN REGION 'IADD' TO DISTRICT 'MARK'.                    ASIG0090
C                                                                       ASIG0100
C                                                                       ASIG0110
C        PARAMETERS                                                     ASIG0120
C                                                                       ASIG0130
C        IADD  -ID NUMBER OF REGION TO BE ASSIGNED. (PASSED)            ASIG0140
C               (PASSED-RETURNED)                                       ASIG0150
C        NLEFT -TOTAL POPULATION LEFT TO BE ASSIGNED.                   ASIG0160
C               (PASSED-RETURNED)                                       ASIG0170
C        ITOT  -TOTAL POPULATION THUS FAR ASSIGNED TO                   ASIG0180
C               DISTRICT 'MARK'. (PASSED-RETURNED)                      ASIG0190
C        KDIFF -CURRENT DEVIATION FROM QUOTA.                           ASIG0200
C               (PASSED-RETURNED)                                       ASIG0210
C                                                                       ASIG0220
C                                                                       ASIG0230
C     . . . . . . . . . . . . . . . . . . . . . . . . . .               ASIG0240
C                                                                       ASIG0250
C                                                                       ASIG0260
C        GLOBAL VARIABLES                                               ASIG0270
C                                                                       ASIG0280
      INTEGER*2  KSIGN,NUM
C
      COMMON        DIST(500),IAVE,ICHUZ,IPOP(500),IQUOTA,MARK,
     *              NAME(500,3),NBER,NDIST,NTDIST,NTOT,NTOTAL(150),
     *              SUM,X(505),Y(505),NFR,IDENT(500),KSIGN(500),NUM(150)
C
C
C        BE SURE THAT REGION IS UNASSIGNED
```

```
      SUBROUTINE CTST (I1,J1,*)
C
C     PURPOSE ...
C
C         THIS SUBROUTINE TESTS THE CONTIGUITY OF DISTRICT MARK
C         ASSUMING THAT REGION NUM(I1) WILL BE ELIMINATED
C
C     METHOD ...
C
C         THE METHOD USED IS PUBLISHED IN
C               JOURNAL OF THE ACM
C               VOL. 9, NUMBER 1
C               JANUARY, 1962
C
C         BY STEPHEN WARSHALL
C
C         AND OUTLINED BELOW
C
C     . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
C
C                            GLOBAL VARIABLES
      INTEGER*2  KSIGN,NUM
C
      COMMON        DIST(500),IAVE,ICHUZ,IPOP(500),IQUOTA,MARK,
     *              NAME(500,3),NBER,NDIST,NTDIST,NTOT,NTOTAL(150),
     *              SUM,X(505),Y(505),NER,IDENT(500),KSIGN(500),NUM(150)
C
      INTEGER*2  IONE, ISORT
C
      COMMON/SAVE/  IONE(13),ISORT(500)
C
C     . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
C
C     PARAMETERS ...
C
C         I1   CO-ORDINATE IN NUM OF REGION TO BE DELETED
```

```
      SUBROUTINE CTSTA (I1,J1,*)
      INTEGER*2  KSIGN,NUM
      COMMON          DIST(500),IAVE,ICHUZ,IPOP(500),IQUOTA,MARK,
     *                NAME(500,3),NBER,NDIST,NTDIST,NTOT,NTOTAL(150),
     *                SUM,X(505),Y(505),NER,IDENT(500),KSIGN(500),NUM(150)
      INTEGER*2  IONE, ISORT
      COMMON/SAVE/  IONE(13),ISORT(500)
      DATA KMEM / 150 /
      COMMON KKIK(13)
      INTEGER*2 KKIK
      II=NUM(I1)
      CALL LOOKUP (II,IONE)
      DO 25 I=1,13
   25 KKIK(I)=IONE(I)
      DO 40 K=1,13
      KK=KKIK(K)
      IF (KK.EQ.0) GO TO 40
      IF (KSIGN(KK).NE.MARK .OR. KK.EQ.II) GO TO 40
      CALL LOOKUP (KK,IONE)
      IKI=0
      DO 39 IJI=1,13
      JIJI=IONE(IJI)
      IF (JIJI .EQ. 0) GO TO 39
      IF (KSIGN(JIJI).NE.MARK .OR.JIJI.EQ.KK) GO TO 39
      IKI=IKI+1
   39 CONTINUE
      IF (IKI .GE. 3) GO TO 40
      RETURN 1
   40 CONTINUE
      RETURN
      END
      SUBROUTINE DISTAN (IREG,ISKIP,MAX,MIN)                            DIST0010
C                                                                       DIST0020
C                                                                       DIST0030
C     . . . . . . . . . . . . . . . . . . . . . . . . . .               DIST0040
C                                                                       DIST0050
C                                                                       DIST0060
C        PURPOSE                                                        DIST0070
C                                                                       DIST0080
C        TO COMPUTE DISTANCES FROM REGION 'IREG' TO OTHER               DIST0090
C        REGIONS.  THE COMPUTED DISTANCES ARE PLACED IN THE             DIST0100
C        GLOBAL VARIABLE 'DIST'.                                        DIST0110
C                                                                       DIST0120
C                                                                       DIST0130
C        PARAMETERS                                                     DIST0140
C                                                                       DIST0150
C        IREG  -REGION FROM WHICH DISTANCES ARE TO BE                   DIST0160
C               COMPUTED. (PASSED)                                      DIST0170
C        ISKIP -CONTROL PARAMETER.  SEE BELOW.                          DIST0180
C        MAX   -ID NUMBER OF THE REGION FARTHEST FROM                   DIST0210
C               REGION 'IREG'. (RETURNED)                               DIST0220
C        MIN   -ID NUMBER OF THE REGION CLOSEST TO REGION               DIST0230
C               'IREG'.  (RETURNED)                                     DIST0240
C                                                                       DIST0250
C                                                                       DIST0260
C     . . . . . . . . . . . . . . . . . . . . . . . . . .               DIST0270
C                                                                       DIST0280
C                                                                       DIST0290
C        GLOBAL VARIABLES                                               DIST0300
C                                                                       DIST0310
      INTEGER*2  KSIGN,NUM
C
      COMMON        DIST(500),IAVE,ICHUZ,IPOP(500),IQUOTA,MARK,
     *              NAME(500,3),NBER,NDIST,NTDIST,NTOT,NTOTAL(150),
     *              SUM,X(505),Y(505),NER,IDENT(500),KSIGN(500),NUM(150)
C
C
```

```
      SUBROUTINE ENCLAV (IADD,J1,NLEFT,ITOT,KDIFF)                      ENCL0010
C                                                                       ENCL0020
C                                                                       ENCL0030
C     . . . . . . . . . . . . . . . . . . . . . . . . . . . .           ENCL0040
C                                                                       ENCL0050
C                                                                       ENCL0060
C        PURPOSE                                                        ENCL0070
C                                                                       ENCL0080
C        AFTER ANY REGION IS ASSIGNED THERE IS A POSSIBILITY            ENCL0090
C        OF ENCLAVING A REGION WHICH HAD CONTIGUITY ONLY                ENCL0100
C        WITH THE REGION JUST ASSIGNED...THUSLY IF THIS                 ENCL0110
C        REGION WERE NOT ASSIGNED AN ENCLAVE WOULD RESULT...            ENCL0120
C        THIS SUBROUTINE FINDS THOSE REGIONS AND ASSIGNS                ENCL0130
C        THEM WITHOUT REGARD TO POPULATION OR DISTANCE                  ENCL0140
C        CRITERION.                                                     ENCL0150
C                                                                       ENCL0160
C     . . . . . . . . . . . . . . . . . . . . . . . . . . . .           ENCL0170
C     GLOBAL VARIABLES                                                  ENCL0180
C                                                                       ENCL0190
      INTEGER*2  KSIGN,NUM
C
      COMMON        DIST(500),IAVE,ICHUZ,IPOP(500),IQUOTA,MARK,
     *              NAME(500,3),NBER,NDIST,NTDIST,NTOT,NTOTAL(150),
     *              SUM,X(505),Y(505),NER,IDENT(500),KSIGN(500),NUM(150)
C
      INTEGER*2  IONE, ISORT
C
      COMMON/SAVE/  IONE(13),ISORT(500)
C
C     . . . . . . . . . . . . . . . . . . . . . . . . . . . .           ENCL0250
C                                                                       ENCL0260
C        PARAMETERS                                                     ENCL0270
C        IADD  -ID NUMBER OF THE REGION JUST ASSIGNED.                  ENCL0280
C              (PASSED)                                                 ENCL0290
C        IONE  -THE CONTIGUITY VECTOR OF THE REGION JUST                ENCL0300
C              ASSIGNED, I.E. IT CONTAINS THE ID NUMBERS                ENCL0310
```

```
      INTEGER FUNCTION ETST(IADD)                                       ETST0010
C                                                                       ETST0020
C     THIS FUNCTION TESTS TO SEE IF THE ADDITION OF REGION IADD         ETST0030
C     WILL CAUSE A SINGLE REGION ENCLAVE.                               ETST0040
C                                                                       ETST0050
C     IF IT DOES, THE FUNCTION VALUE WILL BE THE REGION(S)              ETST0060
C     ENCLAVED.                                                         ETST0070
C                                                                       ETST0080
C     IF IT DOES NOT, THE VALUE WILL BE 0                               ETST0090
C                                                                       ETST0100
C                                                                       ETST0110
C     GLOBAL VARIABLES                                                  ETST0120
C                                                                       ETST0130
      INTEGER*2  KSIGN,NUM
C
      COMMON        DIST(500),IAVE,ICHUZ,IPOP(500),IQUOTA,MARK,
     *              NAME(500,3),NBER,NDIST,NTDIST,NTOT,NTOTAL(150),
     *              SUM,X(505),Y(505),NER,IDENT(500),KSIGN(500),NUM(150)
C
C     LOCAL VARIABLES                                                   ETST0180
C                                                                       ETST0190
      INTEGER*2 IONE(13),JONE(13)                                       ETST0200
C     INITIALIZE ETST                                                   ETST0210
      ETST = 0                                                          ETST0220
C                                                                       ETST0230
C     GET CONTIGUITY DATA FOR REGION 'IADD'                             ETST0240
C                                                                       ETST0250
      CALL LOOKUP(IADD,IONE)                                            ETST0260
      DO 1 I=1,13                                                       ETST0270
      II=IONE(I)                                                        ETST0280
C                                                                       ETST0290
C     JUMP IF ALL CONTIGUITY HAS BEEN CHECKED                           ETST0300
C                                                                       ETST0310
      IF (II.EQ.0) GO TO 11                                             ETST0320
C                                                                       ETST0330
C     JUMP IF THE REGION HAS ALREADY BEEN ASSIGNED                      ETST0340
```

```
      SUBROUTINE IMPROV (ITOT,J1,NLEFT,IFCONT)
C                                                                       IMPR0020
C     . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .       IMPR0030
C                                                                       IMPR0040
C          THIS SUBROUTINE SEARCHES REGIONS AROUND THE BORDER           IMPR0050
C          OF A COMPLETED DISTRICT TO SEE IF ANY REGION CAN             IMPR0060
C          BE ELIMINATED & PLACE DISTRICT CLOSER TO QUOTA               IMPR0070
C                                                                       IMPR0080
C     . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .       IMPR0090
C                                                                       IMPR0100
C          GLOBAL VARIABLES                                             IMPR0110
C                                                                       IMPR0120
      INTEGER*2  KSIGN,NUM
C
      COMMON        DIST(500),IAVE,ICHUZ,IPOP(500),IQUOTA,MARK,
     *              NAME(500,3),NBER,NDIST,NTDIST,NTOT,NTOTAL(150),
     *              SUM,X(505),Y(505),NFR,IDENT(500),KSIGN(500),NUM(150)
C
      INTEGER*2  IONE, ISORT
C
      COMMON/SAVE/  IONE(13),ISORT(500)
C
C     . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .       IMPR0230
C                                                                       IMPR0240
C                                                                       IMPR0250
C     PARAMETERS ...                                                    IMPR0260
C                                                                       IMPR0270
C     ITOT     TOTAL POPULATION OF LAST DISTRICT FORMED                 IMPR0280
C              (DIST. # MARK)       (PASSED-RETURNED)                   IMPR0290
C                                                                       IMPR0300
C     J1       NUMBER OF REGIONS IN DISTRICT MARK  (PASSED)             IMPR0310
C                                                                       IMPR0320
C                                                                       IMPR0330
C     NLEFT    TOTAL UNASSIGNED POPULATION  (PASSED - RETURNED)         IMPR0340
C
C          IFCONT 0 IF DISTRICT CONTIGUITY TO BE CHECKED
```

```
      SUBROUTINE LIST (ILIST)
C
C
C     . . . . . . . . . . . . . . . . . . . . . . . . . . .
C
C
C        PURPOSE
C
C        TO LIST THE NAME, POPULATION, AND INTERNAL ID
C        NUMBER FOR ALL INPUT REGIONS  AND/OR TO LIST CONTIGUITY LISTS
C
C
C        PARAMETERS
C
C        ILIST   DETERMINES THE TYPE OF LISTING ...
C                =1  POPULATION-COORDINATION INFO ONLY
C                =2  CONTIGUITY INFO ONLY
C                =3  BOTH POP-COORD & CONTIG. INFO
C
C
C     . . . . . . . . . . . . . . . . . . . . . . . . . . .
C
C
C        GLOBAL VARIABLES
C
      INTEGER*2  KSIGN,NUM
C
      COMMON        DIST(500),IAVE,ICHUZ,IPOP(500),IQUOTA,MARK,
     *              NAME(500,3),NBER,NDIST,NTDIST,NTOT,NTOTAL(150),
     *              SUM,X(505),Y(505),NFR,IDENT(500),KSIGN(500),NUM(150)
C
      INTEGER*2  ICONT,ICONTL
C
      COMMON /CONT/ ICONT(2500),ICONTL(500)
C
C             CHECK FOR TYPE OF LISTING
```

```
      SUBROUTINE LOOKUP (ID,IONE)                                       LOOK0010
C                                                                       LOOK0020
C                                                                       LOOK0030
C     . . . . . . . . . . . . . . . . . . . . . . . . . .               LOOK0040
C                                                                       LOOK0050
C                                                                       LOOK0060
C        PURPOSE                                                        LOOK0070
C                                                                       LOOK0080
C        TO RETRIEVE THE CONTIGUITY FOR A SPECIFIED REGION.             LOOK0090
C                                                                       LOOK0100
C                                                                       LOOK0110
C        PARAMETERS                                                     LOOK0120
C                                                                       LOOK0130
C        ID    -ID NUMBER OF THE REGION FOR WHICH THE                   LOOK0140
C               CONTIGUITY IS DESIRED. (PASSED)                         LOOK0150
C        IONE  -VECTOR INTO WHICH THE RETRIEVED CONTIGUITY              LOOK0160
C               IS PLACED. (RETURNED)                                   LOOK0170
C                                                                       LOOK0180
C                                                                       LOOK0190
C     . . . . . . . . . . . . . . . . . . . . . . . . . .               LOOK0200
C                                                                       LOOK0210
C                                                                       LOOK0220
      INTEGER*2  ICONT,ICONTL
C
      COMMON /CONT/ ICONT(2500),ICONTL(500)
C
      INTEGER*2 IONE(13)
C                                                                       LOOK0260
C      NOTE ...                                                         LOOK0270
C                                                                       LOOK0280
C      ARGUMENT ID IS INTEGER*4                                         LOOK0290
C     AND THEREFORE CANNOT ACCEPT AN ELEMENT OF                         LOOK0300
C     ARRAYS NUM OR KNUM, WHICH ARE INTEGER*2                           LOOK0310
C                                                                       LOOK0320
C         SET LIMITS
      ILOW = ICONTL(ID)
      SUBROUTINE MPCK (NME,JPICK,MCHECK,J1,IPICK)
C                                                                       MPCK0020
C          THIS SUBROUTINE IS CALLED BY SOLVER IF A MULTIPLE            MPCK0030
C          ENCLAVE OCCURED                                              MPCK0040
C                                                                       MPCK0050
C          ITS PURPOSE IS TO COMPUTE THE DISTANCES WHICH WILL BE        MPCK0060
C          USED BY THE SUBROUTINE TEST TO GENERATE                      MPCK0070
C          THE NEW DISTRICT                                             MPCK0080
C                                                                       MPCK0090
C          BY ALTERING THE METHOD OF COMPUTING DISTANCES.               MPCK0100
C          WE CAN AFFECT THE FORMATION OF A DISTRICT,                   MPCK0110
C          AND IN THAT WAY POSSIBLY CORRECT THE ENCLAVE                 MPCK0120
C                                                                       MPCK0130
C     . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . MPCK0140
      INTEGER*2  KSIGN,NUM
C
      COMMON        DIST(500),IAVE,ICHUZ,IPOP(500),IQUOTA,MARK,
     *              NAME(500,3),NBER,NDIST,NTDIST,NTOT,NTOTAL(150),
     *              SUM,X(505),Y(505),NER,IDENT(500),KSIGN(500),NUM(150)
C
C                                                                       MPCK0190
C          MULTIPLE ENCLAVE VARIABLES                                   MPCK0200
C                                                                       MPCK0210
      DATA MAXME / 5/                                                   MPCK
      DIMENSION  MEA(5)                                                 MPCK
      REAL*8 CORDS(4) / 'NORTH', 'EAST', 'SOUTH', 'WEST' /              MPCK0240
C                                                                       MPCK0250
C     . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . MPCK0260
C                                                                       MPCK0270
C     PARAMETERS                                                        MPCK0280
C                                                                       MPCK0290
C          NME     IS THE NUMBER OF MULTIPLE ENCLAVES                   MPCK0300
C                  THAT HAVE OCCURED FOR THE PRESENT RECOVERY METHOD    MPCK0310
C                                                                       MPCK0320
C                                                                       MPCK0330
C          JPICK   IS THE REGION WHERE THE DISTRICT                     MPCK0340
```

```
      SUBROUTINE MTST (ITOT,J1,IPICK,JPICK,NLEFT,MNPOP,MXPOP)           MTST0010
C                                                                       MTST0020
C     THIS SUBROUTINE TESTS FOR MULTIPLE REGION ENCLAVES THAT           MTST0030
C     MAY HAVE BEEN FORMED BY THE LAST DISTRICT FORMED (MARK)           MTST0040
C                                                                       MTST0050
C     . . . . . . . . . . . . . . . . . . . . . . . . . . . .           MTST0060
C                                                                       MTST0070
C     KNUM IS ACTUALLY ARRAY ISORT FROM SUBROUTINE TEST.                MTST0080
C     IT IS SHARED WITH THIS SUBROUTINE ONLY TO CONSERVE SPACE           MTST0090
C                                                                       MTST0100
C                                                                       MTST0110
      IMPLICIT LOGICAL ($)                                              MTST0120
C                                                                       MTST0130
C                                                                       MTST0160
C     GLOBAL VARIABLES                                                  MTST0170
      INTEGER*2  KSIGN,NUM
C
      COMMON        DIST(500),IAVE,ICHUZ,IPOP(500),IQUOTA,MARK,
     *              NAME(500,3),NBER,NDIST,NTDIST,NTOT,NTOTAL(150),
     *              SUM,X(505),Y(505),NER,IDENT(500),KSIGN(500),NUM(150)
C
      INTEGER*2  IONE, KNUM
C
      COMMON/SAVE/ IONE(13),KNUM(500)
C
C           DEV IS THE MINIMUM ACCEPTABLE DEVIATION FROM IDEAL QUOTA
C           FOR MULTIPLE ENCLAVES.
      DATA DEV / 0.005 /                                                MTST0230
C                                                                       MTST0240
C     . . . . . . . . . . . . . . . . . . . . . . . . . . . .           MTST0250
C                                                                       MTST0260
C                                                                       MTST0270
C     PARAMETERS ...                                                    MTST0280
C                                                                       MTST0290
C     ITOT     TOTAL POPULATION OF LAST DISTRICT (MARK)                 MTST0300
```

```
      SUBROUTINE PICK (IADD,J1,IBIG)                                    PICK0010
C                                                                       PICK0020
C                                                                       PICK0030
C     . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .       PICK0040
C                                                                       PICK0050
C                                                                       PICK0060
C        PURPOSE                                                        PICK0070
C                                                                       PICK0080
C        TO FIND THE UNASSIGNED CONTIGUOUS REGION 'IADD'                PICK0090
C        WHOSE DISTANCE FROM THE FIRST REGION IN DISTRICT  .            PICK0100
C        'MARK' IS MINIMAL                                              PICK0110
C                                                                       PICK0120
C
C     . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
C                                                                       PICK0290
C        GLOBAL VARIABLES                                               PICK0300
C                                                                       PICK0310
      INTEGER*2  KSIGN,NUM
C
      COMMON        DIST(500),IAVE,ICHUZ,IPOP(500),IQUOTA,MARK,
     *              NAME(500,3),NBER,NDIST,NTDIST,NTOT,NTOTAL(150),
     *              SUM,X(505),Y(505),NER,IDENT(500),KSIGN(500),NUM(150)
C
      DATA MAXREG / 150/
      INTEGER*2  IONE, ISORT
C
      COMMON/SAVE/  IONE(13),ISORT(500)
C
      INTEGER*2 JONE(13)
C
C            INTEGER FUNCTION
C
      INTEGER ETST
C
C
C     . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .  PICK0130
```

```
      FUNCTION RANDNO (I)                                               RAND0010
C                                                                       RAND0020
C                                                                       RAND0030
C     . . . . . . . . . . . . . . . . . . . . . . . . . . .             RAND0040
C                                                                       RAND0050
C                                                                       RAND0060
C        PURPOSE                                                        RAND0070
C                                                                       RAND0080
C        TO GENERATE A 0-1 UNIFORMLY DISTRIBUTED RANDOM                 RAND0090
C        NUMBER.                                                        RAND0100
C                                                                       RAND0110
C                                                                       RAND0120
C        PARAMETERS                                                     RAND0130
C                                                                       RAND0140
C        NONE - THE INITIAL SEED IS PLACED IN THE INTEGER               RAND0150
C        STATEMENT.                                                     RAND0160
C                                                                       RAND0170
C                                                                       RAND0180
C        COMMENTS                                                       RAND0190
C                                                                       RAND0200
C        THIS IS A MODIFICATION OF THE IBM 360 SSP                      RAND0210
C        SUBROUTINE RANDU.                                              RAND0220
C                                                                       RAND0230
C                                                                       RAND0240
C     . . . . . . . . . . . . . . . . . . . . . . . . . . .             RAND0250
C                                                                       RAND0260
C                                                                       RAND0270
      INTEGER IX/6175217/                                               RAND0280
      IX = IX*65539                                                     RAND0290
      IF (IX.GE.0)  GO TO 1                                             RAND0300
      IX = IX+2147483647+1                                              RAND0310
    1 RANDNO = IX                                                       RAND0320
      RANDNO = RANDNO*.4656613E-9                                       RAND0330
      RETURN                                                            RAND0340
      END                                                               RAND0350
      SUBROUTINE REDO (ISUM)
C
C
C     THIS SUBROUTINE ALLOWS YOU TO INITIALIZE ANY NUMBER OF DISTRICTS
C     FOR A GIVEN PLAN OR TO RERUN THE SAME PLAN STARTING FROM A
C     GIVEN DISTRICT
C
C     . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
C
C
C                  GLOBAL VARIABLES
C
      INTEGER*2  KSIGN,NUM
C
      COMMON        DIST(500),IAVE,ICHUZ,IPOP(500),IQUOTA,MARK,
     *              NAME(500,3),NBER,NDIST,NTDIST,NTOT,NTOTAL(150),
     *              SUM,X(505),Y(505),NER,IDENT(500),KSIGN(500),NUM(150)
C
      INTEGER*2 IONE,KNUM
C
      COMMON/SAVE/ IONE(13),KNUM(500)
      LOGICAL*1 $SIGN
C
      COMMON/SOLV/  IKODE,IPICK,NTSIGN,NLEFT,IP,ITOT,IFCONT,$SIGN(150)
C
C
C                  LOCAL VARIABLES
C
      DIMENSION KDIST(10)
C
C
C
C     . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
C
C
C     IF THE REDO FLAG (COL. 11) OF CONTROL CARD IS NON-ZERO,
C     THE NEXT CARD MUST BE A REDO CONTROL CARD
```

```
C
C                    **** REDO CONTROL CARD ****
C
C     COL       FIELD
C
C     1-2       INPUT UNIT IF DISTRICTS ARE TO BE READ IN
C               ZERO IF PARTIAL RERUN OF LAST PLAN
C               NEG. IF TOTAL   RERUN OF LAST SUBSET
C      4        NON-ZERO IF DISTRICTS READ IN ARE TO BE PRINTED
C      5        NON-ZERO IF PROBLEM IS TO USE A SUBSET OF THE
C               MASTER FILE (I.E. ONLY THE REGIONS INITIALIZED INTO
C               DISTRICTS ARE TO BE USED FOR REDISTRICTING, AND ALL
C               OTHER REGIONS ARE TO BE IGNORED.)
C     6-10      NUMBER OF DISTRICTS TO BE INITIALIZED
C               (EITHER READ IN OR LEFT ALONE)
C
C
C          ENTRY FLAG
C
      LOGICAL $REDO /.FALSE./
   10 CONTINUE
C
C          READ CONTROL CARD
C
      READ (5,1000) INPUT,LIST, ISUB,MDIST
 1000 FORMAT(I2,1X,I1,I1,I5)
C
C               SET DEFAULT VALUES IF INPUT NEG.
C
      IF (INPUT.GE.0) GO TO 11
C               SUBSET RERUN
      ISUB = 1
      MDIST = 0
C
   11 CONTINUE
C
```

```
      SUBROUTINE SOLVER (RATIO)
C                                                                       SOLV0020
C                                                                       SOLV0030
C     . . . . . . . . . . . . . . . . . . . . . . . . . . .             SOLV0040
C                                                                       SOLV0050
C                                                                       SOLV0060
C        PURPOSE                                                        SOLV0070
C                                                                       SOLV0080
C        THIS ROUTINE RECEIVES CONTROL FROM THE MAIN                    SOLV0090
C        PROGRAM AND REMAINS IN CONTROL UNTIL A PLAN IS                 SOLV0100
C        SUCCESSFULLY COMPLETED OR TERMINATED DUE TO                    SOLV0110
C        ENCLAVES.                                                      SOLV0120
C                                                                       SOLV0130
C     . . . . . . . . . . . . . . . . . . . . . . . . . . .             SOLV0140
C                                                                       SOLV0150
C                                                                       SOLV0160
C        GLOBAL VARIABLES                                               SOLV0170
C                                                                       SOLV0180
      INTEGER*2  KSIGN,NUM
C
      COMMON        DIST(500),IAVE,ICHUZ,IPOP(500),IQUOTA,MARK,
     *              NAME(500,3),NBER,NDIST,NTDIST,NTOT,NTOTAL(150),
     *              SUM,X(505),Y(505),NER,IDENT(500),KSIGN(500),NUM(150)
C
      LOGICAL*1 $SIGN
C
      COMMON/SOLV/  IKODE,IPICK,NTSIGN,NLEFT,IP,ITOT,IECONT,$SIGN(150)
C
C                                                                       SOLV0240
C     . . . . . . . . . . . . . . . . . . . . . . . . . . .             SOLV0250
C                                                                       SOLV0260
C        PARAMETERS                                                     SOLV0270
C                                                                       SOLV0280
C        RATIO -MAXIMUM ALLOWABLE POPULATION VARIANCE RATIO
C
C     THE FOLLOWING PARAMETERS ARE LOCATED IN COMMON/SOLV/
```

```
      SUBROUTINE TEST (JADD,NLEFT,ITOT,J1)
C                                                                       TEST0020
C                                                                       TEST0030
C     . . . . . . . . . . . . . . . . . . . . . . . . . .               TEST0040
C                                                                       TEST0050
C                                                                       TEST0060
C        PURPOSE                                                        TEST0070
C                                                                       TEST0080
C        TO ASSIGN REGIONS TO A DISTRICT UNTIL IT'S DEVATION            TEST0090
C        FROM THE DISTRICT QUOTA IS MINIMIZED.                          TEST0100
C                                                                       TEST0110
C                                                                       TEST0120
C        PARAMETERS                                                     TEST0130
C                                                                       TEST0140
C        JADD  -FIRST REGION TO BE ASSIGNED
C                TO CURRENT DISTRICT
C        NLEFT -TOTAL POPULATION LEFT TO BE ASSIGNED.                   TEST0150
C               (PASSED-RETURNED)                                       TEST0160
C        ITOT  -TOTAL POPULATION ASSIGNED TO CURRENT                    TEST0170
C               DISTRICT. (PASSED-RETURNED)                             TEST0180
C        J1    -NUMBER OF REGIONS IN CURRENT DISTRICT.                  TEST0190
C               (PASSED-RETURNED)                                       TEST0200
C                                                                       TEST0210
C                                                                       TEST0220
C     . . . . . . . . . . . . . . . . . . . . . . . . . .               TEST0230
C                                                                       TEST0240
C                                                                       TEST0250
C        GLOBAL VARIABLES                                               TEST0260
C                                                                       TEST0270
      INTEGER*2  KSIGN,NUM
C
      COMMON        DIST(500),IAVE,ICHUZ,IPOP(500),IQUOTA,MARK,
     *              NAME(500,3),NBER,NDIST,NTDIST,NTOT,NTOTAL(150),
     *              SUM,X(505),Y(505),NER,IDENT(500),KSIGN(500),NUM(150)
C
      INTEGER*2  IONE, ISORT
      SUBROUTINE WRIT (ID,IONE)
C
C          THIS SUBROUTINE TAKES THE CONTIGUITY LIST
C          FOR REGION 'ID', WHICH IS LOCATED IN
C          ARRAY 'IONE' AND PLACES IT INTO MATRIX 'ICONT'
C          IT ALSO SETS THE ARRAY ICONTL TO THE STARTING
C          LOCATION OF THE NEXT REGION IN ICONTL
C
      INTEGER*2  KSIGN,NUM
C
      COMMON         DIST(500),IAVE,ICHUZ,IPOP(500),IQUOTA,MARK,
     *               NAME(500,3),NBER,NDIST,NTDIST,NTOT,NTOTAL(150),
     *               SUM,X(505),Y(505),NER,IDENT(500),KSIGN(500),NUM(150)
C
      INTEGER*2  ICONT,ICONTL
C
      COMMON /CONT/ ICONT(2500),ICONTL(500)
C
      DATA KCONT /2500/
C
      INTEGER*2 IONE(13)
C
C          THE ARRAY ICONTL GIVES THE BEGINNING LOCATION
C          IN ICONT OF THE CONTIGUITY LIST FOR EACH REGION
C
C              CHECK FOR FIRST TIME
      IF (ID.GT.1) GO TO 5
C              FIRST TIME THRU
C              INITIALIZE CONTIGUITY COUNTER & CONT. LOC. PTR.
C              PRINT OUT MAX. NO. OF CONTIGUITY CELLS ALLOWED FOR
C
      NCONT = 0
      ICONTL(1) = 1
      WRITE(6,3000) KCONT
 3000 FORMAT(I10,' MAXIMUM CONTIGUITY CELLS')
    5 CONTINUE
```

## REDIST PROGRAM

### Section I Input Records: Formats and Functions

The formats and functions for REDIST are discussed below. The number of plans or problems processed during one run is unlimited.

1. Control Card

| | |
|---|---|
| Location | Unit 5 |
| Purpose | Specifies the number of regions involved and the unit number they are to read from. If no control cards remain, the program terminates. |

Format

| Column | Purpose |
|---|---|
| 1-5 | Unit number of Master File; if blank 5 is assumed. |
| 6-10 | Number of regions on the master file. |

2. Master File

| | |
|---|---|
| Location | Specified by the Control Card above. |
| Purpose | Defines values for each region. |

There are two types of input records:

population-coordinate which provides the tract and ED numbers of the region, its location, population, and name.

contiguity which specifies regions contiguous to the given region.

The file must contain all population-coordinate cards followed by all contiguity cards in the same order as the population-coordinate cards.

Format — This format is the same as the file created by SETUP when IFILE ≠ 0.

A. Population-Coordinate Cards

| Column | Purpose |
|---|---|
| 1- 4 | Internal sequence number of region. Not used by this program. |

| | |
|---|---|
| 5-13 | Identification number of region with the tract number in columns 5-8 and the ED number in 9-13. This number will be treated as a nine-digit number, rather than separate four- and five-digit numbers. |
| 14-20 | X coordinate of region. |
| 21-27 | Y coordinate of region. |
| 28-34 | Population of region. |
| 35-36 | County number of region. (Optional, as this is not used by any program in the system.) |
| 37-49 | Not used. |
| 50-80 | Name of region. Only the first 12 characters of the name are used. |

B. Contiguity Cards

| Column | Purpose |
|---|---|
| 1-65 | Contains up to 13 contiguity cells. Each cell is a five-digit number giving the internal sequence number of a region contiguous to the given region. |
| 66-71 | Not used. |
| 72-80 | Identification number of region. Not used in this program. |

3. Parameter Card

| | |
|---|---|
| Location | Unit 5 |
| Purpose | Specifies the initial reference region, maximum acceptable population-variance ratio, and title of the plan. It also specifies what method of generating the plan is to be used. |
| Format | Following are the names, location and discussion concerning each parameter. Nonmentioned columns are ignored. If no parameter cards remain, the program terminates. After each parameter card is read, its fields are printed out on the listing. |

A. IPUNCH - Column 1

If zero, no punched output for generated plans is provided.

If nine, a new problem is read next.

If one through eight, punched output of the plan will give the number of districts and plan title, followed by the identification number of each district, the number of regions and the sequence (internal identification) number of regions in each district. Finally it will give the population variance ratio of the plan.

If the plan is abandoned, the punched output will only include up to the last successfully formed district.

This punched output has two purposes:

1. It may be used in a later run with the REDO feature (see D below) to initialize a plan up to a given point.
2. It may be used with one of the Report Generator programs to produce a formal listing of the districts in a given plan.

B. NDIST - Columns 2-5

The number of districts in the plan

C. ICHUZ - Column 10

Specifies optional method of choosing initial reference region.

If 1, a region is picked randomly.

If 2, the reference region is IPICK as discussed in E below.

If 3, the program will attempt to form plans using as a reference region first IPICK, then incrementing by INC until this process exceeds the number of regions (see D and Ia below), and then using four pseudo-reference regions, which are located to the north, east, south, and west of the plan area along either the north-south or east-west bisector of the plan.

D. IFREDO - Column 11 (See Addendum on following pages for running with a subset of the master file.)

If zero, the program will generate each district.

If nonzero, the program will operate on a subset of the master file or will read in up to NDIST initialized districts of the same format as the punched output produces if IPUNCH ≠ 0 or 9 (See A above). The program will expect the next card on unit 5 to be a REDO Control Card. (See paragraph 4 below.)

E. IPICK - Columns 12-15

This is the internal sequence number of the chosen initial reference region when ICHUZ = 2, and the first initial reference region when ICHUZ = 3. If IPICK = 0, then 1 is assumed.

F. RATIO - Columns 16-20

This is a limiting population variance ratio for the plan. If this ratio is exceeded at the completion of a district, the program will discontinue generating the plan and go on to the next control card.

The population variance ratio is computed by dividing the population of the largest district formed by the population of the smallest district.

G. NFR - Columns 21-24

The number of forced regions to be used.

Valid only when ICHUZ = 2 and IKODE = 1. (See C and J.) A forced region is a region chosen to be the generating region (first region) of a district. The user may specify forced regions for any number of districts up to and including the total number of districts, NDIST, to be generated.

If NFR > 0, the program expects to find NFR Forced Region Cards on unit 5 (See 6 below). When the program is about to pick a generating region (first region in the current district), if NFR > 0 the program will read the next Forced Region Card, subtract one from NFR, and assign the forced region to the current district.

If IFREDO = 0 (See D above) then the Forced Region Cards are to be placed after the Parameter Card, and the forced regions will be used to start districts one through NFR.

If IFREDO ≠ 0 then the Forced Region Cards are placed after all necessary Redo Cards (See paragraphs 4 and 5), and the forced regions will be used to start the first NFR districts which have not been initialized. In this case, the number of districts to be initialized plus the number of districts to be forced must not exceed the number to be generated.

H. IFCONT - Column 25

After a district is completed, it will always be over quota and subroutine IMPROV will be called. This subroutine will attempt to bring the population of the district closer to quota by eliminating a region or regions along the edge of the district. If IFCONT = 0, the program will first call subroutine CTST to be sure that elimination of the region will not destroy the contiguity of the district. If IFCONT ≠ 0, then this test will not be made. Assuming that IMPROV has been called, the subroutine logic for each region in the district would be:

1. Is the region contiguous to at least one unassigned region?

2. If the region is deleted, would it put the district closer to quota than all previous regions?

3. If IFCONT = 0, then if the region is deleted, would the district be contiguous?

If the answer to all three of the above questions is yes, the region is saved and the same questions asked for all following regions. After considering all regions, the best choice is eliminated. The advantage of using this option is that the user need not check district contiguity, while the disadvantage is that of time to make this check. The subroutine will check districts with up to 100 regions; more than 100 regions will cause the program to print a message and not check contiguity for that district. This number may be modified through KMEM; see section on Program Modification.

I. ILIST - Column 26

If ILIST = 1 then the program will produce a listing of the regions giving for each region the internal sequence number, the identification number (Tract and ED), the

X and Y coordinates, the population, and name.

If ILIST = 2, the internal sequence number, identification number (Tract and ED), name of region, and contiguity list are provided.

If ILIST = 3, listings for both ILIST = 1 and ILIST = 2.

Ia. INC - Columns 27-29

Valid only when ICHUZ = 3. This is the increment for choosing initial reference regions. If INC = 0, then 1 is assumed.

J. IKODE - Column 30

Valid only when ICHUZ = 2.

This variable specifies how the districts are to be generated.

If IKODE = 0 then the program uses its basic algorithm to generate each district.

If IKODE = 1 then the program uses the regions on the Forced Region Cards to begin the first NFR districts and the basic algorithm for the remainder of the districts.

If IKODE = 2 then the program will generate the first district (not counting districts initialized by REDO) starting with the unassigned region closest to the point described by the X & Y fields (see K & L) given on the current parameter card, and choose subsequent regions on the basis of the region closest to this point. This applies only to the formation of the first district, and the basic algorithm is used for all remaining districts.

K. X - Columns 31-40

Valid only when ICHUZ = 2 and IKODE = 2.

This is the X coordinate of the point described when IKODE = 2 (See J).

L. Y - Columns 41-50

Valid only when ICHUZ = 2 and IKODE = 2.

This is the Y coordinate of the point described when IKODE = 2 (See J).

M. Title - Columns 51-80

Plan title.

This appears at the top of the first page of the plan listing and on the header card of punched output if 0 < IPUNCH < 9.

4. REDO Control Card (See Addendum for running with a subset of the master file.)

Location Unit 5, immediately following Parameter Card (See paragraph 3 above) with IFREDO ≠ 0.

Purpose Specifies the form of REDO option to be used. There are basically two types of REDO options:* the first is to initialize a given number of districts by reading in punched output from some previous run; the second method is to restart the previous plan after eliminating specified districts. With the REDO feature, the user may set up any number of districts by using the first option, and then create several revised plans by using the second option during the same run.

| Function | Columns | Name | Function |
|---|---|---|---|
| | 1-2 | INPUT | If non zero, the unit number of the district specification cards to be read (Option 1).<br>If zero, the program assumes that this will be a rerun of the previous plan. (Option 2). |
| | 4 | LIST | If non zero, the program will print out the data that will be read in. This will take one of two forms, depending on the value of INPUT:<br>If INPUT equal zero, the districts will be eliminated.<br>If INPUT is non zero, the regions in each of the districs to be initialized. |

---

*Other than the subset option which is discussed separately in the Addendum.

| Columns | Name | Function |
|---|---|---|
| 5 | | Non zero for a subset problem. See preceeding Addendum. |
| 6-10 | MDIST | The number of districts of a previous plan to be saved. The exact action depends on the value of INPUT. If INPUT equal zero, the program expects to find the identification of the NDIST-MDIST districts to be eliminated on REDO cards (See paragraph 5 below) on unit 5.<br>If input is non zero, the program expects to find MDIST district specification cards on unit INPUT (Columns 1-2). |

The REDO feature simply sets up part or all of some previous plan. After these districts are initialized, the Parameter Card (See paragraph 3 above) controls the completion of the plan. Any option of the Parameter Card may be used after initialization. Another possibility is that the user may initialize all districts, and then use the second option to rerun various individual groups of districts. If ICHUZ = 3 is used, a plan will be generated using each of the unassigned regions as a reference region. Districts which are read in keep the same identification numbers that they had when first formed. If punched output is requested, the initialized districts are not punched.

5. REDO Card

| | |
|---|---|
| Location | Unit 5, immediately after a REDO Control Card (See paragraph 4 above) with INPUT = 0. |
| Purpose | Specifies which districts from the previous run are to be eliminated. |
| Format | Up to 10 five-digit identification numbers in Columns 1 through 50. More than 1 card may be used, but not embedded blank fields are allowed. |

6. Forced Region Card

| | |
|---|---|
| Location | Unit 5. immediately following cards for REDO feature |

(or Parameter Card).

| | |
|---|---|
| **Purpose** | Specifies forced starting region for next district. |
| Format | Internal sequence number of forced region is punched in Columns 1-5. |

## Section II Program Modification

Sizes are coded as follows:

| | |
|---|---|
| R | maximum number of regions |
| D | maximum number of districts. |
| M | maximum number of regions in a district. |
| C | maximum number of contiguity cells (total). |

1. Arrays Located in Common Blocks

| Name | Size | Function |
|---|---|---|
| | | - BLANK COMMON- |
| DIST | R | Contains distance from reference point to region. |
| IPOP | R | Population of region. |
| NAME | R,3 | Name of region. |
| NTOTAL | D | Population of district. |
| X | R+5 | X coordinate of region (and 5 pseudo-regions) |
| Y | R+5 | Y coordinate of region (and 5 pseudo-regions) |
| IDENT | R | Identification number of region (tract & ED) |

# ADDENDUM

## Running with a Subset of the Master File

A most useful feature of the Redistricting program is its ability to run using only a subset of the master file. This feature is useful in

a. subdividing a larger problem into a series of smaller problems, say to preserve existing geographical boundaries on the border of the subset area,

b. to complete plans which have terminated in a previous run due to enclave difficulties,

c. to improve population of compactness variations in certain areas of completed plants.

All subset runs must be done through the REDO option. All valid parameters on the main parameter card for the subset problem may be used.

### Changes to REDO Control Card

Column 5 must be non-zero if the plan is to use a subset (var. ISUB) of the master file. Also, Redo options used will be printed under options from the main parameter card.

### Directions for Use

I. Defining a Subset

  a. Redo control card

  Columns

  1-2 - input unit of district specification cares which contain the internal region identification numbers defining the subset

  4 - non-zero if these districts are to be printed

  5 - non-zero to indicate a subset

  6-10 - number of districts to be read

  b. Action

  The program will set the KSIGN value of regions not in the subset to an unavailable value, which will not allow them to be used as long as Redo is invoked. If IFREDO = 0 on some main parameter card, the subset will be destroyed at that time. If another subset is to be read, the program will destroy the old subset and then create the new. The parameter card that invoked Redo will then take control as though no districts had been initialized (i.e., NDIST should be the number of districts wanted. This is not the same as initializing an entire plan).

II. Subsequent Runs of the Previous Subset

a. Redo control cards

Columns

1-2 - zero if some of the districts are to be left alone, negative if all districts to be eliminated

4&5 - Same as columns 4 and 5 and 6-10 when Input = 0

6-10 - (column 1-2); Blank when Input < 0.

b. Action

if Input = 0, same action as though the run was with the entire master file. (See paragraph 4, "REDO Control Card" of text.)

if input < 0, all regions in subset will be unassigned.

Note: If input < 0, the remainder of the cards may be blank, since the program will set ISUB = 1 and MDIST = 0 and LIST is not used.

Example

Example Parameter and Redo Control Cards are shown below. The first pair of cards are for Area 8, a subset area of the master file. In this area we desire to generate 12 districts (columns 4 and 5) with punched district specification output (column 1), with ICHUZ = 2 (column 10) and IPICK = 2601 (columns 12-15). The use of the Redo feature is shown in Column 11. The second card indicates that the region internal identification numbers defining Area 8 may be read from unit 1 (column 2), that a subset is being used (column 5), and that district specification cards for one district includes all region numbers in subset Area 8 (column 10).

The next four cards describe the desire to generate 5 districts from Area 9 but generating two plans using two starting points, regions 3494 and 1095. The fourth of these cards for Area 9 includes a -1 column (columns 1 and 2) to indicate that the subset data for Area 9 previously read is to be utilized again.

The last two cards are included for contrast. In this case 100 districts without punched output are desired using ICHUZ = 3. However 97 of the 100 districts with specification cards given on unit 3 (as shown on the last card) are to be preserved, and only the 98th, 99th, and 100th districts generated using ICHUZ = 3. Thus the program is generating three districts starting with every sixth region (column 29) in the excluded area. The contrast here is that in the first two examples districts were generated in the area included by the cards read from unit 1 while in the last example the districting was done in an area excluded by the cards on unit 3. Note that the last example has a blank in Column 5 indicating that this is not a subset problem in the sense of this Addendum; rather it is the case covered in the original documentation. The zero punch of Column 4 sets LIST = 0 to avoid listing 97 districts already known.

## IV. The Linear Programming Districting Models

MPSX programs are divided into two sections: a control program, which sets up the linear programming problem, solves it, and performs the necessary sensitivity analysis; and, a data program which provides the information on problem structure. In each of the linear programming models, we have included a copy of the control program used, although we will not describe these in detail (please refer to the relevant manuals). The data deck includes the problem name (NAME); the names and types of each row (N = objective function, E = equality, G = greater than or equal to, L = less than or equal to); the column names and their non-zero coefficients for each row; and the right-hand side values for each row (when non-zero). In the listings, the control program includes all cards numbered as CNTL.

In the rows section, the COST row is the sum of the absolute values of all errors from district population quotas. The DIST row is the total distance from all blocks to the district centers to which they are assigned. These two values form the objective functions.

Rows D1 to D8 require that all districts must be assigned to some blocks, in this case

$$\sum_{i=1}^{93} X_{ij} = g_j \quad \forall\, j$$

This is the Helbig formulation.

Rows U1-U93 require that each block is assigned to a district:

$$\sum_{i=1}^{8} X_{ij} = 1 \quad \forall\, i$$

Rows POP1 to POP8 compute the difference between district populations and their quota values:

$$\sum_{i=1}^{93} p_i X_{ij} + PLUS_j - MINUS_j = q_j$$

Columns U1D1 to U93D8 are the amounts shipped from block i to district j, with i ranging from 1 to 93 and j from 1 to 8: these are the $X_{ij}$ variables described above.

Columns PLUS1 to PLUS8 and MINUS1 to MINUS8 are the positive and negative errors from quota. They are found in rows POP and are summed to give the row COST.

Right hand side values in RHS are the quotas, $q_j$, and the requirements, $g_j$ or 1.

```
          PROGRAM                                                       CNTL0001
          INITIALZ                                                      CNTL0002
          MOVE (XDATA,'DISTA')                                          CNTL0003
          MOVE (XPBNAME,'HLBLKS')                                       CNTL0004
          CONVERT                                                       CNTL0005
          MOVE (XOBJ,'DIST')                                            CNTL0006
          MOVE (XRHS,'RHS')                                             CNTL0007
          SETUP                                                         CNTL0008
          OPTIMIZE                                                      CNTL0009
          SOLUTION ('BASIS')                                            CNTL0010
          EXIT                                                          CNTL0011
          PEND                                                          CNTL0012
//MPSEXEC.SYSIN DD *,DCB=(RECFM=FB,LRECL=80,BLKSIZE=2000)               CNTL0013
```

```
NAME          DISTA                                                   ROWS0001
ROWS                                                                  ROWS0002
 N  COST                                                              ROWS0003
 N  DIST                                                              ROWS0004
 E  D1                                                                ROWS0005
 E  D2                                                                ROWS0006
 E  D3                                                                ROWS0007
 E  D4                                                                ROWS0008
 E  D5                                                                ROWS0009
 E  D6                                                                ROWS0010
 E  D7                                                                ROWS0011
 E  D8                                                                ROWS0012
 E  U1                                                                ROWS0013
 E  U2                                                                ROWS0014
 E  U3                                                                ROWS0015
 E  U4                                                                ROWS0016
 E  U5                                                                ROWS0017
 E  U6                                                                ROWS0018
 E  U7                                                                ROWS0019
 E  U8                                                                ROWS0020
 E  U9                                                                ROWS0021
 E  U10                                                               ROWS0022
 E  U11                                                               ROWS0023
 E  U12                                                               ROWS0024
 E  U13                                                               ROWS0025
 E  U14                                                               ROWS0026
 E  U15                                                               ROWS0027
 E  U16                                                               ROWS0028
 E  U17                                                               ROWS0029
 E  U18                                                               ROWS0030
 E  U19                                                               ROWS0031
 E  U20                                                               ROWS0032
 E  U21                                                               ROWS0033
 E  U23                                                               ROWS0034
 E  U22                                                               ROWS0035
 E  U24                                                               ROWS0036
```

```
E  U25                                                          ROWS0037
E  U26                                                          ROWS0038
E  U27                                                          ROWS0039
E  U28                                                          ROWS0040
E  U29                                                          ROWS0041
E  U30                                                          ROWS0042
E  U31                                                          ROWS0043
E  U32                                                          ROWS0044
E  U33                                                          ROWS0045
E  U34                                                          ROWS0046
E  U35                                                          ROWS0047
E  U36                                                          ROWS0048
E  U37                                                          ROWS0049
E  U38                                                          ROWS0050
E  U39                                                          ROWS0051
E  U40                                                          ROWS0052
E  U41                                                          ROWS0053
E  U42                                                          ROWS0054
E  U43                                                          ROWS0055
E  U44                                                          ROWS0056
E  U45                                                          ROWS0057
E  U46                                                          ROWS0058
E  U47                                                          ROWS0059
E  U48                                                          ROWS0060
E  U49                                                          ROWS0061
E  U50                                                          ROWS0062
E  U51                                                          ROWS0063
E  U52                                                          ROWS0064
E  U53                                                          ROWS0065
E  U54                                                          ROWS0066
E  U55                                                          ROWS0067
E  U56                                                          ROWS0068
E  U57                                                          ROWS0069
E  U58                                                          ROWS0070
E  U59                                                          ROWS0071
E  U60                                                          ROWS0072
```

```
 E  U61                                                                ROWS0073
 E  U62                                                                ROWS0074
 E  U63                                                                ROWS0075
 E  U64                                                                ROWS0076
 E  U65                                                                ROWS0077
 E  U66                                                                ROWS0078
 E  U67                                                                ROWS0079
 E  U68                                                                ROWS0080
 E  U69                                                                ROWS0081
 E  U70                                                                ROWS0082
 E  U71                                                                ROWS0083
 E  U72                                                                ROWS0084
 E  U73                                                                ROWS0085
 E  U74                                                                ROWS0086
 E  U75                                                                ROWS0087
 E  U76                                                                ROWS0088
 E  U77                                                                ROWS0089
 E  U78                                                                ROWS0090
 E  U79                                                                ROWS0091
 E  U80                                                                ROWS0092
 E  U81                                                                ROWS0093
 E  U82                                                                ROWS0094
 E  U83                                                                ROWS0095
 E  U84                                                                ROWS0096
 E  U85                                                                ROWS0097
 E  U86                                                                ROWS0098
 E  U87                                                                ROWS0099
 E  U88                                                                ROWS0100
 E  U89                                                                ROWS0101
 E  U90                                                                ROWS0102
 E  U91                                                                ROWS0103
 E  U92                                                                ROWS0104
 E  U93                                                                ROWS0105
 N  POP1                                                               ROWS0106
 N  POP2                                                               ROWS0107
 G  POP3                                                               ROWS0108
```

```
N    POP4                                                                                    ROWS0109
N    POP5                                                                                    ROWS0110
N    POP6                                                                                    ROWS0111
N    POP7                                                                                    ROWS0112
N    POP8                                                                                    ROWS0113
```

```
COLUMNS
    PLUS1     POP1          1.0    COST          1.0          POPC0001
    PLUS2     POP2          1.0    COST          1.0          POPC0002
    PLUS3     POP3          1.0    COST          1.0          POPC0003
    PLUS4     POP4          1.0    COST          1.0          POPC0004
    PLUS5     POP5          1.0    COST          1.0          POPC0005
    PLUS6     POP6          1.0    COST          1.0          POPC0006
    PLUS7     POP7          1.0    COST          1.0          POPC0007
    PLUS8     POP8          1.0    COST          1.0          POPC0008
    MINUS1    POP1         -1.0    COST          1.0          POPC0009
    MINUS2    POP2         -1.0    COST          1.0          POPC0010
    MINUS3    POP3         -1.0    COST          1.0          POPC0011
    MINUS4    POP4         -1.0    COST          1.0          POPC0012
    MINUS5    POP5         -1.0    COST          1.0          POPC0013
    MINUS6    POP6         -1.0    COST          1.0          POPC0014
    MINUS7    POP7         -1.0    COST          1.0          POPC0015
    MINUS8    POP8         -1.0    COST          1.0          POPC0016
                                                              POPC0017
```

```
U1D1      U1          1.0     D1          1.0                DISC0001
U1D1      POP1       62.00    DIST       16.65               DISC0002
U1D2      U1          1.0     D2          1.0                DISC0003
U1D2      POP2       62.00    DIST       34.51               DISC0004
U1D3      U1          1.0     D3          1.0                DISC0005
U1D3      POP3       62.00    DIST       47.40               DISC0006
U1D4      U1          1.0     D4          1.0                DISC0007
U1D4      POP4       62.00    DIST       35.85               DISC0008
U1D5      U1          1.0     D5          1.0                DISC0009
U1D5      POP5       62.00    DIST       36.59               DISC0010
U1D6      U1          1.0     D6          1.0                DISC0011
U1D6      POP6       62.00    DIST       56.04               DISC0012
U1D7      U1          1.0     D7          1.0                DISC0013
U1D7      POP7       62.00    DIST       69.96               DISC0014
U1D8      U1          1.0     D8          1.0                DISC0015
U1D8      POP8       62.00    DIST       53.86               DISC0016
U2D1      U2          1.0     D1          1.0                DISC0017
U2D1      POP1      664.00    DIST       13.84               DISC0018
U2D2      U2          1.0     D2          1.0                DISC0019
U2D2      POP2      664.00    DIST       31.52               DISC0020
U2D3      U2          1.0     D3          1.0                DISC0021
U2D3      POP3      664.00    DIST       44.69               DISC0022
U2D4      U2          1.0     D4          1.0                DISC0023
U2D4      POP4      664.00    DIST       34.16               DISC0024
U2D5      U2          1.0     D5          1.0                DISC0025
U2D5      POP5      664.00    DIST       36.02               DISC0026
U2D6      U2          1.0     D6          1.0                DISC0027
U2D6      POP6      664.00    DIST       55.78               DISC0028
U2D7      U2          1.0     D7          1.0                DISC0029
U2D7      POP7      664.00    DIST       69.15               DISC0030
U2D8      U2          1.0     D8          1.0                DISC0031
U2D8      POP8      664.00    DIST       52.70               DISC0032
U3D1      U3          1.0     D1          1.0                DISC0033
U3D1      POP1     1002.00    DIST        9.22               DISC0034
U3D2      U3          1.0     D2          1.0                DISC0035
U3D2      POP2     1002.00    DIST       27.10               DISC0036
```

```
    U3D3      U3              1.0   D3               1.0                    DISC0037
    U3D3      POP3        1002.00   DIST           39.99                    DISC0038
    U3D4      U3              1.0   D4               1.0                    DISC0039
    U3D4      POP4        1002.00   DIST           29.26                    DISC0040
    U3D5      U3              1.0   D5               1.0                    DISC0041
    U3D5      POP5        1002.00   DIST           31.64                    DISC0042
    U3D6      U3              1.0   D6               1.0                    DISC0043
    U3D6      POP6        1002.00   DIST           51.55                    DISC0044
    U3D7      U3              1.0   D7               1.0                    DISC0045
    U3D7      POP7        1002.00   DIST           64.54                    DISC0046
    U3D8      U3              1.0   D8               1.0                    DISC0047
    U3D8      POP8        1002.00   DIST           47.94                    DISC0048
    U4D1      U4              1.0   D1               1.0                    DISC0049
    U4D1      POP1         259.00   DIST            7.54                    DISC0050
    U4D2      U4              1.0   D2               1.0                    DISC0051
    U4D2      POP2         259.00   DIST           24.69                    DISC0052
    U4D3      U4              1.0   D3               1.0                    DISC0053
    U4D3      POP3         259.00   DIST           36.63                    DISC0054
    U4D4      U4              1.0   D4               1.0                    DISC0055
    U4D4      POP4         259.00   DIST           24.42                    DISC0056
    U4D5      U4              1.0   D5               1.0                    DISC0057
    U4D5      POP5         259.00   DIST           26.32                    DISC0058
    U4D6      U4              1.0   D6               1.0                    DISC0059
    U4D6      POP6         259.00   DIST           46.24                    DISC0060
    U4D7      U4              1.0   D7               1.0                    DISC0061
    U4D7      POP7         259.00   DIST           59.27                    DISC0062
    U4D8      U4              1.0   D8               1.0                    DISC0063
    U4D8      POP8         259.00   DIST           42.78                    DISC0064
    U5D1      U5              1.0   D1               1.0                    DISC0065
    U5D1      POP1         161.00   DIST           11.60                    DISC0066
    U5D2      U5              1.0   D2               1.0                    DISC0067
    U5D2      POP2         161.00   DIST           27.51                    DISC0068
    U5D3      U5              1.0   D3               1.0                    DISC0069
    U5D3      POP3         161.00   DIST           38.42                    DISC0070
    U5D4      U5              1.0   D4               1.0                    DISC0071
    U5D4      POP4         161.00   DIST           24.28                    DISC0072
```

```
U5D5      U5          1.0   D5          1.0               DISC0073
U5D5      POP5      161.00  DIST       24.05              DISC0074
U5D6      U5          1.0   D6          1.0               DISC0075
U5D6      POP6      161.00  DIST       43.61              DISC0076
U5D7      U5          1.0   D7          1.0               DISC0077
U5D7      POP7      161.00  DIST       57.43              DISC0078
U5D8      U5          1.0   D8          1.0               DISC0079
U5D8      POP8      161.00  DIST       41.49              DISC0080
U6D1      U6          1.0   D1          1.0               DISC0081
U6D1      POP1      177.00  DIST        7.83              DISC0082
U6D2      U6          1.0   D2          1.0               DISC0083
U6D2      POP2      177.00  DIST       22.61              DISC0084
U6D3      U6          1.0   D3          1.0               DISC0085
U6D3      POP3      177.00  DIST       33.60              DISC0086
U6D4      U6          1.0   D4          1.0               DISC0087
U6D4      POP4      177.00  DIST       20.36              DISC0088
U6D5      U6          1.0   D5          1.0               DISC0089
U6D5      POP5      177.00  DIST       22.21              DISC0090
U6D6      U6          1.0   D6          1.0               DISC0091
U6D6      POP6      177.00  DIST       42.18              DISC0092
U6D7      U6          1.0   D7          1.0               DISC0093
U6D7      POP7      177.00  DIST       55.06              DISC0094
U6D8      U6          1.0   D8          1.0               DISC0095
U6D8      POP8      177.00  DIST       38.56              DISC0096
U7D1      U7          1.0   D1          1.0               DISC0097
U7D1      POP1      248.00  DIST        4.00              DISC0098
U7D2      U7          1.0   D2          1.0               DISC0099
U7D2      POP2      248.00  DIST       21.27              DISC0100
U7D3      U7          1.0   D3          1.0               DISC0101
U7D3      POP3      248.00  DIST       33.58              DISC0102
U7D4      U7          1.0   D4          1.0               DISC0103
U7D4      POP4      248.00  DIST       22.68              DISC0104
U7D5      U7          1.0   D5          1.0               DISC0105
U7D5      POP5      248.00  DIST       26.19              DISC0106
U7D6      U7          1.0   D6          1.0               DISC0107
U7D6      POP6      248.00  DIST       46.21              DISC0108
```

```
U7D7      U7         1.0      D7          1.0                DISC0109
U7D7      POP7     248.00     DIST       58.50               DISC0110
U7D8      U7         1.0      D8          1.0                DISC0111
U7D8      POP8     248.00     DIST       41.65               DISC0112
U8D1      U8         1.0      D1          1.0                DISC0113
U8D1      POP1     988.00     DIST        6.52               DISC0114
U8D2      U8         1.0      D2          1.0                DISC0115
U8D2      POP2     988.00     DIST       24.08               DISC0116
U8D3      U8         1.0      D3          1.0                DISC0117
U8D3      POP3     988.00     DIST       37.32               DISC0118
U8D4      U8         1.0      D4          1.0                DISC0119
U8D4      POP4     988.00     DIST       27.95               DISC0120
U8D5      U8         1.0      D5          1.0                DISC0121
U8D5      POP5     988.00     DIST       31.67               DISC0122
U8D6      U8         1.0      D6          1.0                DISC0123
U8D6      POP6     988.00     DIST       51.69               DISC0124
U8D7      U8         1.0      D7          1.0                DISC0125
U8D7      POP7     988.00     DIST       64.00               DISC0126
U8D8      U8         1.0      D8          1.0                DISC0127
U8D8      POP8     988.00     DIST       47.10               DISC0128
U9D1      U9         1.0      D1          1.0                DISC0129
U9D1      POP1     227.00     DIST       12.72               DISC0130
U9D2      U9         1.0      D2          1.0                DISC0131
U9D2      POP2     227.00     DIST       29.55               DISC0132
U9D3      U9         1.0      D3          1.0                DISC0133
U9D3      POP3     227.00     DIST       43.17               DISC0134
U9D4      U9         1.0      D4          1.0                DISC0135
U9D4      POP4     227.00     DIST       34.32               DISC0136
U9D5      U9         1.0      D5          1.0                DISC0137
U9D5      POP5     227.00     DIST       37.53               DISC0138
U9D6      U9         1.0      D6          1.0                DISC0139
U9D6      POP6     227.00     DIST       57.49               DISC0140
U9D7      U9         1.0      D7          1.0                DISC0141
U9D7      POP7     227.00     DIST       70.19               DISC0142
U9D8      U9         1.0      D8          1.0                DISC0143
U9D8      POP8     227.00     DIST       53.39               DISC0144
```

```
U10D1    U10         1.0    D1          1.0               DISC0145
U10D1    POP1      219.00   DIST       12.50              DISC0146
U10D2    U10         1.0    D2          1.0               DISC0147
U10D2    POP2      219.00   DIST       27.19              DISC0148
U10D3    U10         1.0    D3          1.0               DISC0149
U10D3    POP3      219.00   DIST       41.18              DISC0150
U10D4    U10         1.0    D4          1.0               DISC0151
U10D4    POP4      219.00   DIST       34.54              DISC0152
U10D5    U10         1.0    D5          1.0               DISC0153
U10D5    POP5      219.00   DIST       39.29              DISC0154
U10D6    U10         1.0    D6          1.0               DISC0155
U10D6    POP6      219.00   DIST       59.30              DISC0156
U10D7    U10         1.0    D7          1.0               DISC0157
U10D7    POP7      219.00   DIST       71.14              DISC0158
U10D8    U10         1.0    D8          1.0               DISC0159
U10D8    POP8      219.00   DIST       54.01              DISC0160
U11D1    U11         1.0    D1          1.0               DISC0161
U11D1    POP1      793.00   DIST        5.70              DISC0162
U11D2    U11         1.0    D2          1.0               DISC0163
U11D2    POP2      793.00   DIST       20.62              DISC0164
U11D3    U11         1.0    D3          1.0               DISC0165
U11D3    POP3      793.00   DIST       34.40              DISC0166
U11D4    U11         1.0    D4          1.0               DISC0167
U11D4    POP4      793.00   DIST       27.51              DISC0168
U11D5    U11         1.0    D5          1.0               DISC0169
U11D5    POP5      793.00   DIST       33.07              DISC0170
U11D6    U11         1.0    D6          1.0               DISC0171
U11D6    POP6      793.00   DIST       52.98              DISC0172
U11D7    U11         1.0    D7          1.0               DISC0173
U11D7    POP7      793.00   DIST       64.28              DISC0174
U11D8    U11         1.0    D8          1.0               DISC0175
U11D8    POP8      793.00   DIST       47.05              DISC0176
U12D1    U12         1.0    D1          1.0               DISC0177
U12D1    POP1      286.00   DIST        0.00              DISC0178
U12D2    U12         1.0    D2          1.0               DISC0179
U12D2    POP2      286.00   DIST       17.90              DISC0180
```

```
U12D3     U12            1.0     D3           1.0               DISC0181
U12D3     POP3         286.00    DIST        30.85              DISC0182
U12D4     U12            1.0     D4           1.0               DISC0183
U12D4     POP4         286.00    DIST        22.05              DISC0184
U12D5     U12            1.0     D5           1.0               DISC0185
U12D5     POP5         286.00    DIST        27.39              DISC0186
U12D6     U12            1.0     D6           1.0               DISC0187
U12D6     POP6         286.00    DIST        47.28              DISC0188
U12D7     U12            1.0     D7           1.0               DISC0189
U12D7     POP7         286.00    DIST        58.67              DISC0190
U12D8     U12            1.0     D8           1.0               DISC0191
U12D8     POP8         286.00    DIST        41.51              DISC0192
U13D1     U13            1.0     D1           1.0               DISC0193
U13D1     POP1         399.00    DIST        10.19              DISC0194
U13D2     U13            1.0     D2           1.0               DISC0195
U13D2     POP2         399.00    DIST        13.28              DISC0196
U13D3     U13            1.0     D3           1.0               DISC0197
U13D3     POP3         399.00    DIST        27.39              DISC0198
U13D4     U13            1.0     D4           1.0               DISC0199
U13D4     POP4         399.00    DIST        25.46              DISC0200
U13D5     U13            1.0     D5           1.0               DISC0201
U13D5     POP5         399.00    DIST        34.00              DISC0202
U13D6     U13            1.0     D6           1.0               DISC0203
U13D6     POP6         399.00    DIST        53.00              DISC0204
U13D7     U13            1.0     D7           1.0               DISC0205
U13D7     POP7         399.00    DIST        62.21              DISC0206
U13D8     U13            1.0     D8           1.0               DISC0207
U13D8     POP8         399.00    DIST        44.75              DISC0208
U14D1     U14            1.0     D1           1.0               DISC0209
U14D1     POP1         333.00    DIST        10.00              DISC0210
U14D2     U14            1.0     D2           1.0               DISC0211
U14D2     POP2         333.00    DIST        20.36              DISC0212
U14D3     U14            1.0     D3           1.0               DISC0213
U14D3     POP3         333.00    DIST        34.47              DISC0214
U14D4     U14            1.0     D4           1.0               DISC0215
U14D4     POP4         333.00    DIST        30.34              DISC0216
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U14D5     U14           1.0     D5            1.0                 DISC0217
U14D5     POP5        333.00    DIST         37.13                DISC0218
U14D6     U14           1.0     D6            1.0                 DISC0219
U14D6     POP6        333.00    DIST         56.83                DISC0220
U14D7     U14           1.0     D7            1.0                 DISC0221
U14D7     POP7        333.00    DIST         67.32                DISC0222
U14D8     U14           1.0     D8            1.0                 DISC0223
U14D8     POP8        333.00    DIST         49.93                DISC0224
U15D1     U15           1.0     D1            1.0                 DISC0225
U15D1     POP1         23.00    DIST         15.81                DISC0226
U15D2     U15           1.0     D2            1.0                 DISC0227
U15D2     POP2         23.00    DIST         27.22                DISC0228
U15D3     U15           1.0     D3            1.0                 DISC0229
U15D3     POP3         23.00    DIST         41.32                DISC0230
U15D4     U15           1.0     D4            1.0                 DISC0231
U15D4     POP4         23.00    DIST         37.17                DISC0232
U15D5     U15           1.0     D5            1.0                 DISC0233
U15D5     POP5         23.00    DIST         43.19                DISC0234
U15D6     U15           1.0     D6            1.0                 DISC0235
U15D6     POP6         23.00    DIST         63.09                DISC0236
U15D7     U15           1.0     D7            1.0                 DISC0237
U15D7     POP7         23.00    DIST         74.11                DISC0238
U15D8     U15           1.0     D8            1.0                 DISC0239
U15D8     POP8         23.00    DIST         56.77                DISC0240
U16D1     U16           1.0     D1            1.0                 DISC0241
U16D1     POP1        899.00    DIST         19.47                DISC0242
U16D2     U16           1.0     D2            1.0                 DISC0243
U16D2     POP2        899.00    DIST         27.95                DISC0244
U16D3     U16           1.0     D3            1.0                 DISC0245
U16D3     POP3        899.00    DIST         41.83                DISC0246
U16D4     U16           1.0     D4            1.0                 DISC0247
U16D4     POP4        899.00    DIST         39.81                DISC0248
U16D5     U16           1.0     D5            1.0                 DISC0249
U16D5     POP5        899.00    DIST         46.76                DISC0250
U16D6     U16           1.0     D6            1.0                 DISC0251
U16D6     POP6        899.00    DIST         66.49                DISC0252
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U16D7     U16          1.0    D7          1.0              DISC0253
U16D7     POP7       899.00   DIST       76.78             DISC0254
U16D8     U16          1.0    D8          1.0              DISC0255
U16D8     POP8       899.00   DIST       59.35             DISC0256
U17D1     U17          1.0    D1          1.0              DISC0257
U17D1     POP1      2834.00   DIST       15.21             DISC0258
U17D2     U17          1.0    D2          1.0              DISC0259
U17D2     POP2      2834.00   DIST       21.88             DISC0260
U17D3     U17          1.0    D3          1.0              DISC0261
U17D3     POP3      2834.00   DIST       35.79             DISC0262
U17D4     U17          1.0    D4          1.0              DISC0263
U17D4     POP4      2834.00   DIST       34.21             DISC0264
U17D5     U17          1.0    D5          1.0              DISC0265
U17D5     POP5      2834.00   DIST       41.87             DISC0266
U17D6     U17          1.0    D6          1.0              DISC0267
U17D6     POP6      2834.00   DIST       61.34             DISC0268
U17D7     U17          1.0    D7          1.0              DISC0269
U17D7     POP7      2834.00   DIST       71.10             DISC0270
U17D8     U17          1.0    D8          1.0              DISC0271
U17D8     POP8      2834.00   DIST       53.65             DISC0272
U18D1     U18          1.0    D1          1.0              DISC0273
U18D1     POP1      2092.00   DIST       16.55             DISC0274
U18D2     U18          1.0    D2          1.0              DISC0275
U18D2     POP2      2092.00   DIST       17.51             DISC0276
U18D3     U18          1.0    D3          1.0              DISC0277
U18D3     POP3      2092.00   DIST       30.90             DISC0278
U18D4     U18          1.0    D4          1.0              DISC0279
U18D4     POP4      2092.00   DIST       31.99             DISC0280
U18D5     U18          1.0    D5          1.0              DISC0281
U18D5     POP5      2092.00   DIST       41.00             DISC0282
U18D6     U18          1.0    D6          1.0              DISC0283
U18D6     POP6      2092.00   DIST       59.79             DISC0284
U18D7     U18          1.0    D7          1.0              DISC0285
U18D7     POP7      2092.00   DIST       68.34             DISC0286
U18D8     U18          1.0    D8          1.0              DISC0287
U18D8     POP8      2092.00   DIST       50.92             DISC0288
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U19D1     U19            1.0   D1             1.0                      DISC0289
U19D1     POP1         375.00  DIST          14.64                     DISC0290
U19D2     U19            1.0   D2             1.0                      DISC0291
U19D2     POP2         375.00  DIST          12.50                     DISC0292
U19D3     U19            1.0   D3             1.0                      DISC0293
U19D3     POP3         375.00  DIST          26.08                     DISC0294
U19D4     U19            1.0   D4             1.0                      DISC0295
U19D4     POP4         375.00  DIST          27.30                     DISC0296
U19D5     U19            1.0   D5             1.0                      DISC0297
U19D5     POP5         375.00  DIST          36.83                     DISC0298
U19D6     U19            1.0   D6             1.0                      DISC0299
U19D6     POP6         375.00  DIST          55.23                     DISC0300
U19D7     U19            1.0   D7             1.0                      DISC0301
U19D7     POP7         375.00  DIST          63.41                     DISC0302
U19D8     U19            1.0   D8             1.0                      DISC0303
U19D8     POP8         375.00  DIST          46.02                     DISC0304
U20D1     U20            1.0   D1             1.0                      DISC0305
U20D1     POP1        3384.00  DIST          25.11                     DISC0306
U20D2     U20            1.0   D2             1.0                      DISC0307
U20D2     POP2        3384.00  DIST          11.19                     DISC0308
U20D3     U20            1.0   D3             1.0                      DISC0309
U20D3     POP3        3384.00  DIST          18.55                     DISC0310
U20D4     U20            1.0   D4             1.0                      DISC0311
U20D4     POP4        3384.00  DIST          28.31                     DISC0312
U20D5     U20            1.0   D5             1.0                      DISC0313
U20D5     POP5        3384.00  DIST          39.88                     DISC0314
U20D6     U20            1.0   D6             1.0                      DISC0315
U20D6     POP6        3384.00  DIST          55.51                     DISC0316
U20D7     U20            1.0   D7             1.0                      DISC0317
U20D7     POP7        3384.00  DIST          60.41                     DISC0318
U20D8     U20            1.0   D8             1.0                      DISC0319
U20D8     POP8        3384.00  DIST          43.83                     DISC0320
U21D1     U21            1.0   D1             1.0                      DISC0321
U21D1     POP1         691.00  DIST          20.88                     DISC0322
U21D2     U21            1.0   D2             1.0                      DISC0323
U21D2     POP2         691.00  DIST           7.11                     DISC0324
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    U21D3     U21        1.0    D3        1.0                 DISC0325
    U21D3     POP3     691.00   DIST     17.49                DISC0326
    U21D4     U21        1.0    D4        1.0                 DISC0327
    U21D4     POP4     691.00   DIST     24.46                DISC0328
    U21D5     U21        1.0    D5        1.0                 DISC0329
    U21D5     POP5     691.00   DIST     35.78                DISC0330
    U21D6     U21        1.0    D6        1.0                 DISC0331
    U21D6     POP6     691.00   DIST     52.07                DISC0332
    U21D7     U21        1.0    D7        1.0                 DISC0333
    U21D7     POP7     691.00   DIST     57.93                DISC0334
    U21D8     U21        1.0    D8        1.0                 DISC0335
    U21D8     POP8     691.00   DIST     41.00                DISC0336
    U22D1     U22        1.0    D1        1.0                 DISC0337
    U22D1     POP1     106.00   DIST     18.67                DISC0338
    U22D2     U22        1.0    D2        1.0                 DISC0339
    U22D2     POP2     106.00   DIST      5.01                DISC0340
    U22D3     U22        1.0    D3        1.0                 DISC0341
    U22D3     POP3     106.00   DIST     17.18                DISC0342
    U22D4     U22        1.0    D4        1.0                 DISC0343
    U22D4     POP4     106.00   DIST     22.28                DISC0344
    U22D5     U22        1.0    D5        1.0                 DISC0345
    U22D5     POP5     106.00   DIST     33.43                DISC0346
    U22D6     U22        1.0    D6        1.0                 DISC0347
    U22D6     POP6     106.00   DIST     50.07                DISC0348
    U22D7     U22        1.0    D7        1.0                 DISC0349
    U22D7     POP7     106.00   DIST     56.46                DISC0350
    U22D8     U22        1.0    D8        1.0                 DISC0351
    U22D8     POP8     106.00   DIST     39.36                DISC0352
    U23D1     U23        1.0    D1        1.0                 DISC0353
    U23D1     POP1     272.00   DIST     15.39                DISC0354
    U23D2     U23        1.0    D2        1.0                 DISC0355
    U23D2     POP2     272.00   DIST      7.02                DISC0356
    U23D3     U23        1.0    D3        1.0                 DISC0357
    U23D3     POP3     272.00   DIST     20.61                DISC0358
    U23D4     U23        1.0    D4        1.0                 DISC0359
    U23D4     POP4     272.00   DIST     22.90                DISC0360
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U23D5     U23          1.0    D5        1.0                DISC0361
U23D5     POP5       272.00   DIST     33.30               DISC0362
U23D6     U23          1.0    D6        1.0                DISC0363
U23D6     POP6       272.00   DIST     50.92               DISC0364
U23D7     U23          1.0    D7        1.0                DISC0365
U23D7     POP7       272.00   DIST     58.35               DISC0366
U23D8     U23          1.0    D8        1.0                DISC0367
U23D8     POP8       272.00   DIST     41.04               DISC0368
U24D1     U24          1.0    D1        1.0                DISC0369
U24D1     POP1       244.00   DIST     12.75               DISC0370
U24D2     U24          1.0    D2        1.0                DISC0371
U24D2     POP2       244.00   DIST      5.83               DISC0372
U24D3     U24          1.0    D3        1.0                DISC0373
U24D3     POP3       244.00   DIST     19.90               DISC0374
U24D4     U24          1.0    D4        1.0                DISC0375
U24D4     POP4       244.00   DIST     19.30               DISC0376
U24D5     U24          1.0    D5        1.0                DISC0377
U24D5     POP5       244.00   DIST     29.37               DISC0378
U24D6     U24          1.0    D6        1.0                DISC0379
U24D6     POP6       244.00   DIST     47.30               DISC0380
U24D7     U24          1.0    D7        1.0                DISC0381
U24D7     POP7       244.00   DIST     55.36               DISC0382
U24D8     U24          1.0    D8        1.0                DISC0383
U24D8     POP8       244.00   DIST     37.95               DISC0384
U25D1     U25          1.0    D1        1.0                DISC0385
U25D1     POP1      1675.00   DIST     17.90               DISC0386
U25D2     U25          1.0    D2        1.0                DISC0387
U25D2     POP2      1675.00   DIST      0.00               DISC0388
U25D3     U25          1.0    D3        1.0                DISC0389
U25D3     POP3      1675.00   DIST     14.11               DISC0390
U25D4     U25          1.0    D4        1.0                DISC0391
U25D4     POP4      1675.00   DIST     17.36               DISC0392
U25D5     U25          1.0    D5        1.0                DISC0393
U25D5     POP5      1675.00   DIST     28.72               DISC0394
U25D6     U25          1.0    D6        1.0                DISC0395
U25D6     POP6      1675.00   DIST     45.07               DISC0396
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U25D7     U25          1.0     D7          1.0                    DISC0397
U25D7     POP7      1675.00    DIST       51.62                   DISC0398
U25D8     U25          1.0     D8          1.0                    DISC0399
U25D8     POP8      1675.00    DIST       34.44                   DISC0400
U26D1     U26          1.0     D1          1.0                    DISC0401
U26D1     POP1       448.00    DIST       23.75                   DISC0402
U26D2     U26          1.0     D2          1.0                    DISC0403
U26D2     POP2       448.00    DIST        6.10                   DISC0404
U26D3     U26          1.0     D3          1.0                    DISC0405
U26D3     POP3       448.00    DIST        8.24                   DISC0406
U26D4     U26          1.0     D4          1.0                    DISC0407
U26D4     POP4       448.00    DIST       17.73                   DISC0408
U26D5     U26          1.0     D5          1.0                    DISC0409
U26D5     POP5       448.00    DIST       29.73                   DISC0410
U26D6     U26          1.0     D6          1.0                    DISC0411
U26D6     POP6       448.00    DIST       43.89                   DISC0412
U26D7     U26          1.0     D7          1.0                    DISC0413
U26D7     POP7       448.00    DIST       48.52                   DISC0414
U26D8     U26          1.0     D8          1.0                    DISC0415
U26D8     POP8       448.00    DIST       31.91                   DISC0416
U27D1     U27          1.0     D1          1.0                    DISC0417
U27D1     POP1       453.00    DIST       29.29                   DISC0418
U27D2     U27          1.0     D2          1.0                    DISC0419
U27D2     POP2       453.00    DIST       11.89                   DISC0420
U27D3     U27          1.0     D3          1.0                    DISC0421
U27D3     POP3       453.00    DIST       11.66                   DISC0422
U27D4     U27          1.0     D4          1.0                    DISC0423
U27D4     POP4       453.00    DIST       25.93                   DISC0424
U27D5     U27          1.0     D5          1.0                    DISC0425
U27D5     POP5       453.00    DIST       37.95                   DISC0426
U27D6     U27          1.0     D6          1.0                    DISC0427
U27D6     POP6       453.00    DIST       51.31                   DISC0428
U27D7     U27          1.0     D7          1.0                    DISC0429
U27D7     POP7       453.00    DIST       54.36                   DISC0430
U27D8     U27          1.0     D8          1.0                    DISC0431
U27D8     POP8       453.00    DIST       38.55                   DISC0432
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U28D1     U28          1.0    D1          1.0                    DISC0433
U28D1     POP1      2018.00   DIST       31.68                   DISC0434
U28D2     U28          1.0    D2          1.0                    DISC0435
U28D2     POP2      2018.00   DIST       13.78                   DISC0436
U28D3     U28          1.0    D3          1.0                    DISC0437
U28D3     POP3      2018.00   DIST        7.23                   DISC0438
U28D4     U28          1.0    D4          1.0                    DISC0439
U28D4     POP4      2018.00   DIST       24.22                   DISC0440
U28D5     U28          1.0    D5          1.0                    DISC0441
U28D5     POP5      2018.00   DIST       36.13                   DISC0442
U28D6     U28          1.0    D6          1.0                    DISC0443
U28D6     POP6      2018.00   DIST       47.82                   DISC0444
U28D7     U28          1.0    D7          1.0                    DISC0445
U28D7     POP7      2018.00   DIST       49.76                   DISC0446
U28D8     U28          1.0    D8          1.0                    DISC0447
U28D8     POP8      2018.00   DIST       34.52                   DISC0448
U29D1     U29          1.0    D1          1.0                    DISC0449
U29D1     POP1      2014.00   DIST       34.65                   DISC0450
U29D2     U29          1.0    D2          1.0                    DISC0451
U29D2     POP2      2014.00   DIST       17.10                   DISC0452
U29D3     U29          1.0    D3          1.0                    DISC0453
U29D3     POP3      2014.00   DIST        5.03                   DISC0454
U29D4     U29          1.0    D4          1.0                    DISC0455
U29D4     POP4      2014.00   DIST       23.59                   DISC0456
U29D5     U29          1.0    D5          1.0                    DISC0457
U29D5     POP5      2014.00   DIST       35.03                   DISC0458
U29D6     U29          1.0    D6          1.0                    DISC0459
U29D6     POP6      2014.00   DIST       44.74                   DISC0460
U29D7     U29          1.0    D7          1.0                    DISC0461
U29D7     POP7      2014.00   DIST       45.39                   DISC0462
U29D8     U29          1.0    D8          1.0                    DISC0463
U29D8     POP8      2014.00   DIST       30.93                   DISC0464
U30D1     U30          1.0    D1          1.0                    DISC0465
U30D1     POP1      2049.00   DIST       26.87                   DISC0466
U30D2     U30          1.0    D2          1.0                    DISC0467
U30D2     POP2      2049.00   DIST        9.84                   DISC0468
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U30D3    U30          1.0   D3          1.0            DISC0469
U30D3    POP3     2049.00   DIST        4.27           DISC0470
U30D4    U30          1.0   D4          1.0            DISC0471
U30D4    POP4     2049.00   DIST       17.18           DISC0472
U30D5    U30          1.0   D5          1.0            DISC0473
U30D5    POP5     2049.00   DIST       29.12           DISC0474
U30D6    U30          1.0   D6          1.0            DISC0475
U30D6    POP6     2049.00   DIST       41.70           DISC0476
U30D7    U30          1.0   D7          1.0            DISC0477
U30D7    POP7     2049.00   DIST       45.27           DISC0478
U30D8    U30          1.0   D8          1.0            DISC0479
U30D8    POP8     2049.00   DIST       29.07           DISC0480
U31D1    U31          1.0   D1          1.0            DISC0481
U31D1    POP1     2051.00   DIST       30.85           DISC0482
U31D2    U31          1.0   D2          1.0            DISC0483
U31D2    POP2     2051.00   DIST       14.11           DISC0484
U31D3    U31          1.0   D3          1.0            DISC0485
U31D3    POP3     2051.00   DIST        0.00           DISC0486
U31D4    U31          1.0   D4          1.0            DISC0487
U31D4    POP4     2051.00   DIST       18.56           DISC0488
U31D5    U31          1.0   D5          1.0            DISC0489
U31D5    POP5     2051.00   DIST       30.06           DISC0490
U31D6    U31          1.0   D6          1.0            DISC0491
U31D6    POP6     2051.00   DIST       40.65           DISC0492
U31D7    U31          1.0   D7          1.0            DISC0493
U31D7    POP7     2051.00   DIST       42.72           DISC0494
U31D8    U31          1.0   D8          1.0            DISC0495
U31D8    POP8     2051.00   DIST       27.28           DISC0496
U32D1    U32          1.0   D1          1.0            DISC0497
U32D1    POP1      810.00   DIST       23.75           DISC0498
U32D2    U32          1.0   D2          1.0            DISC0499
U32D2    POP2      810.00   DIST       10.30           DISC0500
U32D3    U32          1.0   D3          1.0            DISC0501
U32D3    POP3      810.00   DIST        8.54           DISC0502
U32D4    U32          1.0   D4          1.0            DISC0503
U32D4    POP4      810.00   DIST       10.61           DISC0504
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U32D5     U32           1.0   D5        1.0                    DISC0505
U32D5     POP5        810.00  DIST     22.56                   DISC0506
U32D6     U32           1.0   D6        1.0                    DISC0507
U32D6     POP6        810.00  DIST     36.09                   DISC0508
U32D7     U32           1.0   D7        1.0                    DISC0509
U32D7     POP7        810.00  DIST     41.43                   DISC0510
U32D8     U32           1.0   D8        1.0                    DISC0511
U32D8     POP8        810.00  DIST     24.44                   DISC0512
U33D1     U33           1.0   D1        1.0                    DISC0513
U33D1     POP1       2304.00  DIST     22.47                   DISC0514
U33D2     U33           1.0   D2        1.0                    DISC0515
U33D2     POP2       2304.00  DIST     12.34                   DISC0516
U33D3     U33           1.0   D3        1.0                    DISC0517
U33D3     POP3       2304.00  DIST     12.26                   DISC0518
U33D4     U33           1.0   D4        1.0                    DISC0519
U33D4     POP4       2304.00  DIST      6.58                   DISC0520
U33D5     U33           1.0   D5        1.0                    DISC0521
U33D5     POP5       2304.00  DIST     18.55                   DISC0522
U33D6     U33           1.0   D6        1.0                    DISC0523
U33D6     POP6       2304.00  DIST     32.90                   DISC0524
U33D7     U33           1.0   D7        1.0                    DISC0525
U33D7     POP7       2304.00  DIST     39.53                   DISC0526
U33D8     U33           1.0   D8        1.0                    DISC0527
U33D8     POP8       2304.00  DIST     22.20                   DISC0528
U34D1     U34           1.0   D1        1.0                    DISC0529
U34D1     POP1       1184.00  DIST     22.05                   DISC0530
U34D2     U34           1.0   D2        1.0                    DISC0531
U34D2     POP2       1184.00  DIST     17.36                   DISC0532
U34D3     U34           1.0   D3        1.0                    DISC0533
U34D3     POP3       1184.00  DIST     18.56                   DISC0534
U34D4     U34           1.0   D4        1.0                    DISC0535
U34D4     POP4       1184.00  DIST      0.00                   DISC0536
U34D5     U34           1.0   D5        1.0                    DISC0537
U34D5     POP5       1184.00  DIST     12.02                   DISC0538
U34D6     U34           1.0   D6        1.0                    DISC0539
U34D6     POP6       1184.00  DIST     28.02                   DISC0540
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U34D7     U34           1.0    D7            1.0                     DISC0541
U34D7     POP7       1184.00   DIST         36.98                    DISC0542
U34D8     U34           1.0    D8            1.0                     DISC0543
U34D8     POP8       1184.00   DIST         19.60                    DISC0544
U35D1     U35           1.0    D1            1.0                     DISC0545
U35D1     POP1        945.00   DIST         17.72                    DISC0546
U35D2     U35           1.0    D2            1.0                     DISC0547
U35D2     POP2        945.00   DIST         11.51                    DISC0548
U35D3     U35           1.0    D3            1.0                     DISC0549
U35D3     POP3        945.00   DIST         16.34                    DISC0550
U35D4     U35           1.0    D4            1.0                     DISC0551
U35D4     POP4        945.00   DIST          6.11                    DISC0552
U35D5     U35           1.0    D5            1.0                     DISC0553
U35D5     POP5        945.00   DIST         17.24                    DISC0554
U35D6     U35           1.0    D6            1.0                     DISC0555
U35D6     POP6        945.00   DIST         34.12                    DISC0556
U35D7     U35           1.0    D7            1.0                     DISC0557
U35D7     POP7        945.00   DIST         42.57                    DISC0558
U35D8     U35           1.0    D8            1.0                     DISC0559
U35D8     POP8        945.00   DIST         25.11                    DISC0560
U36D1     U36           1.0    D1            1.0                     DISC0561
U36D1     POP1       1425.00   DIST         19.66                    DISC0562
U36D2     U36           1.0    D2            1.0                     DISC0563
U36D2     POP2       1425.00   DIST         19.24                    DISC0564
U36D3     U36           1.0    D3            1.0                     DISC0565
U36D3     POP3       1425.00   DIST         22.85                    DISC0566
U36D4     U36           1.0    D4            1.0                     DISC0567
U36D4     POP4       1425.00   DIST          4.72                    DISC0568
U36D5     U36           1.0    D5            1.0                     DISC0569
U36D5     POP5       1425.00   DIST          9.60                    DISC0570
U36D6     U36           1.0    D6            1.0                     DISC0571
U36D6     POP6       1425.00   DIST         28.18                    DISC0572
U36D7     U36           1.0    D7            1.0                     DISC0573
U36D7     POP7       1425.00   DIST         39.04                    DISC0574
U36D8     U36           1.0    D8            1.0                     DISC0575
U36D8     POP8       1425.00   DIST         22.09                    DISC0576
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U37D1     U37          1.0    D1          1.0                       DISC0577
U37D1     POP1        83.00   DIST       19.79                      DISC0578
U37D2     U37          1.0    D2          1.0                       DISC0579
U37D2     POP2        83.00   DIST       21.73                      DISC0580
U37D3     U37          1.0    D3          1.0                       DISC0581
U37D3     POP3        83.00   DIST       25.89                      DISC0582
U37D4     U37          1.0    D4          1.0                       DISC0583
U37D4     POP4        83.00   DIST        7.62                      DISC0584
U37D5     U37          1.0    D5          1.0                       DISC0585
U37D5     POP5        83.00   DIST        7.90                      DISC0586
U37D6     U37          1.0    D6          1.0                       DISC0587
U37D6     POP6        83.00   DIST       27.51                      DISC0588
U37D7     U37          1.0    D7          1.0                       DISC0589
U37D7     POP7        83.00   DIST       39.51                      DISC0590
U37D8     U37          1.0    D8          1.0                       DISC0591
U37D8     POP8        83.00   DIST       23.05                      DISC0592
U38D1     U38          1.0    D1          1.0                       DISC0593
U38D1     POP1      1879.00   DIST       20.58                      DISC0594
U38D2     U38          1.0    D2          1.0                       DISC0595
U38D2     POP2      1879.00   DIST       24.82                      DISC0596
U38D3     U38          1.0    D3          1.0                       DISC0597
U38D3     POP3      1879.00   DIST       29.42                      DISC0598
U38D4     U38          1.0    D4          1.0                       DISC0599
U38D4     POP4      1879.00   DIST       11.07                      DISC0600
U38D5     U38          1.0    D5          1.0                       DISC0601
U38D5     POP5      1879.00   DIST        7.07                      DISC0602
U38D6     U38          1.0    D6          1.0                       DISC0603
U38D6     POP6      1879.00   DIST       27.06                      DISC0604
U38D7     U38          1.0    D7          1.0                       DISC0605
U38D7     POP7      1879.00   DIST       40.25                      DISC0606
U38D8     U38          1.0    D8          1.0                       DISC0607
U38D8     POP8      1879.00   DIST       24.52                      DISC0608
U39D1     U39          1.0    D1          1.0                       DISC0609
U39D1     POP1      2286.00   DIST       10.73                      DISC0610
U39D2     U39          1.0    D2          1.0                       DISC0611
U39D2     POP2      2286.00   DIST       16.70                      DISC0612
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U39D3     U39          1.0    D3          1.0              DISC0613
U39D3     POP3      2286.00   DIST       25.72             DISC0614
U39D4     U39          1.0    D4          1.0              DISC0615
U39D4     POP4      2286.00   DIST       12.08             DISC0616
U39D5     U39          1.0    D5          1.0              DISC0617
U39D5     POP5      2286.00   DIST       16.90             DISC0618
U39D6     U39          1.0    D6          1.0              DISC0619
U39D6     POP6      2236.00   DIST       36.63             DISC0620
U39D7     U39          1.0    D7          1.0              DISC0621
U39D7     POP7      2286.00   DIST       48.05             DISC0622
U39D8     U39          1.0    D8          1.0              DISC0623
U39D8     POP8      2286.00   DIST       31.04             DISC0624
U40D1     U40          1.0    D1          1.0              DISC0625
U40D1     POP1      2261.00   DIST        7.66             DISC0626
U40D2     U40          1.0    D2          1.0              DISC0627
U40D2     POP2      2261.00   DIST       10.29             DISC0628
U40D3     U40          1.0    D3          1.0              DISC0629
U40D3     POP3      2261.00   DIST       23.32             DISC0630
U40D4     U40          1.0    D4          1.0              DISC0631
U40D4     POP4      2261.00   DIST       17.54             DISC0632
U40D5     U40          1.0    D5          1.0              DISC0633
U40D5     POP5      2261.00   DIST       25.88             DISC0634
U40D6     U40          1.0    D6          1.0              DISC0635
U40D6     POP6      2261.00   DIST       44.86             DISC0636
U40D7     U40          1.0    D7          1.0              DISC0637
U40D7     POP7      2261.00   DIST       54.48             DISC0638
U40D8     U40          1.0    D8          1.0              DISC0639
U40D8     POP8      2261.00   DIST       37.04             DISC0640
U41D1     U41          1.0    D1          1.0              DISC0641
U41D1     POP1       649.00   DIST        9.69             DISC0642
U41D2     U41          1.0    D2          1.0              DISC0643
U41D2     POP2       649.00   DIST       19.62             DISC0644
U41D3     U41          1.0    D3          1.0              DISC0645
U41D3     POP3       649.00   DIST       29.26             DISC0646
U41D4     U41          1.0    D4          1.0              DISC0647
U41D4     POP4       649.00   DIST       15.17             DISC0648
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U41D5     U41         1.0     D5        1.0          DISC0649
U41D5     POP5     649.00     DIST    17.91          DISC0650
U41D6     U41         1.0     D6        1.0          DISC0651
U41D6     POP6     649.00     DIST    37.92          DISC0652
U41D7     U41         1.0     D7        1.0          DISC0653
U41D7     POP7     649.00     DIST    50.20          DISC0654
U41D8     U41         1.0     D8        1.0          DISC0655
U41D8     POP8     649.00     DIST    33.51          DISC0656
U42D1     U42         1.0     D1        1.0          DISC0657
U42D1     POP1     285.00     DIST    10.75          DISC0658
U42D2     U42         1.0     D2        1.0          DISC0659
U42D2     POP2     285.00     DIST    22.18          DISC0660
U42D3     U42         1.0     D3        1.0          DISC0661
U42D3     POP3     285.00     DIST    31.71          DISC0662
U42D4     U42         1.0     D4        1.0          DISC0663
U42D4     POP4     285.00     DIST    16.90          DISC0664
U42D5     U42         1.0     D5        1.0          DISC0665
U42D5     POP5     285.00     DIST    17.98          DISC0666
U42D6     U42         1.0     D6        1.0          DISC0667
U42D6     POP6     285.00     DIST    37.96          DISC0668
U42D7     U42         1.0     D7        1.0          DISC0669
U42D7     POP7     285.00     DIST    50.89          DISC0670
U42D8     U42         1.0     D8        1.0          DISC0671
U42D8     POP8     285.00     DIST    34.52          DISC0672
U43D1     U43         1.0     D1        1.0          DISC0673
U43D1     POP1     374.00     DIST    13.32          DISC0674
U43D2     U43         1.0     D2        1.0          DISC0675
U43D2     POP2     374.00     DIST    25.67          DISC0676
U43D3     U43         1.0     D3        1.0          DISC0677
U43D3     POP3     374.00     DIST    34.88          DISC0678
U43D4     U43         1.0     D4        1.0          DISC0679
U43D4     POP4     374.00     DIST    19.14          DISC0680
U43D5     U43         1.0     D5        1.0          DISC0681
U43D5     POP5     374.00     DIST    18.02          DISC0682
U43D6     U43         1.0     D6        1.0          DISC0683
U43D6     POP6     374.00     DIST    37.66          DISC0684
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    U43D7     U43          1.0   D7          1.0                    DISC0685
    U43D7     POP7       374.00  DIST       51.41                   DISC0686
    U43D8     U43          1.0   D8          1.0                    DISC0687
    U43D8     POP8       374.00  DIST       35.58                   DISC0688
    U44D1     U44          1.0   D1          1.0                    DISC0689
    U44D1     POP1       285.00  DIST       16.62                   DISC0690
    U44D2     U44          1.0   D2          1.0                    DISC0691
    U44D2     POP2       285.00  DIST       26.04                   DISC0692
    U44D3     U44          1.0   D3          1.0                    DISC0693
    U44D3     POP3       285.00  DIST       33.53                   DISC0694
    U44D4     U44          1.0   D4          1.0                    DISC0695
    U44D4     POP4       285.00  DIST       16.40                   DISC0696
    U44D5     U44          1.0   D5          1.0                    DISC0697
    U44D5     POP5       285.00  DIST       13.59                   DISC0698
    U44D6     U44          1.0   D6          1.0                    DISC0699
    U44D6     POP6       285.00  DIST       33.14                   DISC0700
    U44D7     U44          1.0   D7          1.0                    DISC0701
    U44D7     POP7       285.00  DIST       47.03                   DISC0702
    U44D8     U44          1.0   D8          1.0                    DISC0703
    U44D8     POP8       285.00  DIST       31.49                   DISC0704
    U45D1     U45          1.0   D1          1.0                    DISC0705
    U45D1     POP1      1667.00  DIST       24.28                   DISC0706
    U45D2     U45          1.0   D2          1.0                    DISC0707
    U45D2     POP2      1667.00  DIST       29.26                   DISC0708
    U45D3     U45          1.0   D3          1.0                    DISC0709
    U45D3     POP3      1667.00  DIST       33.14                   DISC0710
    U45D4     U45          1.0   D4          1.0                    DISC0711
    U45D4     POP4      1667.00  DIST       14.58                   DISC0712
    U45D5     U45          1.0   D5          1.0                    DISC0713
    U45D5     POP5      1667.00  DIST        5.83                   DISC0714
    U45D6     U45          1.0   D6          1.0                    DISC0715
    U45D6     POP6      1667.00  DIST       24.55                   DISC0716
    U45D7     U45          1.0   D7          1.0                    DISC0717
    U45D7     POP7      1667.00  DIST       38.94                   DISC0718
    U45D8     U45          1.0   D8          1.0                    DISC0719
    U45D8     POP8      1667.00  DIST       24.44                   DISC0720
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U46D1     U46          1.0     D1           1.0                          DISC0721
U46D1     POP1        89.00    DIST        25.23                         DISC0722
U46D2     U46          1.0     D2           1.0                          DISC0723
U46D2     POP2        89.00    DIST        31.80                         DISC0724
U46D3     U46          1.0     D3           1.0                          DISC0725
U46D3     POP3        89.00    DIST        36.22                         DISC0726
U46D4     U46          1.0     D4           1.0                          DISC0727
U46D4     POP4        89.00    DIST        17.68                         DISC0728
U46D5     U46          1.0     D5           1.0                          DISC0729
U46D5     POP5        89.00    DIST         8.49                         DISC0730
U46D6     U46          1.0     D6           1.0                          DISC0731
U46D6     POP6        89.00    DIST        25.55                         DISC0732
U46D7     U46          1.0     D7           1.0                          DISC0733
U46D7     POP7        89.00    DIST        40.66                         DISC0734
U46D8     U46          1.0     D8           1.0                          DISC0735
U46D8     POP8        89.00    DIST        26.91                         DISC0736
U47D1     U47          1.0     D1           1.0                          DISC0737
U47D1     POP1       109.00    DIST        17.50                         DISC0738
U47D2     U47          1.0     D2           1.0                          DISC0739
U47D2     POP2       109.00    DIST        29.54                         DISC0740
U47D3     U47          1.0     D3           1.0                          DISC0741
U47D3     POP3       109.00    DIST        37.89                         DISC0742
U47D4     U47          1.0     D4           1.0                          DISC0743
U47D4     POP4       109.00    DIST        21.01                         DISC0744
U47D5     U47          1.0     D5           1.0                          DISC0745
U47D5     POP5       109.00    DIST        17.24                         DISC0746
U47D6     U47          1.0     D6           1.0                          DISC0747
U47D6     POP6       109.00    DIST        36.01                         DISC0748
U47D7     U47          1.0     D7           1.0                          DISC0749
U47D7     POP7       109.00    DIST        50.60                         DISC0750
U47D8     U47          1.0     D8           1.0                          DISC0751
U47D8     POP8       109.00    DIST        35.59                         DISC0752
U48D1     U48          1.0     D1           1.0                          DISC0753
U48D1     POP1       102.00    DIST        30.34                         DISC0754
U48D2     U48          1.0     D2           1.0                          DISC0755
U48D2     POP2       102.00    DIST        34.85                         DISC0756
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    U48D3     U48            1.0     D3          1.0                      DISC0757
    U48D3     POP3         102.00    DIST       37.23                     DISC0758
    U48D4     U48            1.0     D4          1.0                      DISC0759
    U48D4     POP4         102.00    DIST       18.94                     DISC0760
    U48D5     U48            1.0     D5          1.0                      DISC0761
    U48D5     POP5         102.00    DIST        7.22                     DISC0762
    U48D6     U48            1.0     D6          1.0                      DISC0763
    U48D6     POP6         102.00    DIST       20.19                     DISC0764
    U48D7     U48            1.0     D7          1.0                      DISC0765
    U48D7     POP7         102.00    DIST       35.83                     DISC0766
    U48D8     U48            1.0     D8          1.0                      DISC0767
    U48D8     POP8         102.00    DIST       23.48                     DISC0768
    U49D1     U49            1.0     D1          1.0                      DISC0769
    U49D1     POP1         327.00    DIST       37.65                     DISC0770
    U49D2     U49            1.0     D2          1.0                      DISC0771
    U49D2     POP2         327.00    DIST       40.08                     DISC0772
    U49D3     U49            1.0     D3          1.0                      DISC0773
    U49D3     POP3         327.00    DIST       40.03                     DISC0774
    U49D4     U49            1.0     D4          1.0                      DISC0775
    U49D4     POP4         327.00    DIST       23.03                     DISC0776
    U49D5     U49            1.0     D5          1.0                      DISC0777
    U49D5     POP5         327.00    DIST       11.41                     DISC0778
    U49D6     U49            1.0     D6          1.0                      DISC0779
    U49D6     POP6         327.00    DIST       13.29                     DISC0780
    U49D7     U49            1.0     D7          1.0                      DISC0781
    U49D7     POP7         327.00    DIST       29.77                     DISC0782
    U49D8     U49            1.0     D8          1.0                      DISC0783
    U49D8     POP8         327.00    DIST       20.58                     DISC0784
    U50D1     U50            1.0     D1          1.0                      DISC0785
    U50D1     POP1         554.00    DIST       35.65                     DISC0786
    U50D2     U50            1.0     D2          1.0                      DISC0787
    U50D2     POP2         554.00    DIST       37.07                     DISC0788
    U50D3     U50            1.0     D3          1.0                      DISC0789
    U50D3     POP3         554.00    DIST       36.70                     DISC0790
    U50D4     U50            1.0     D4          1.0                      DISC0791
    U50D4     POP4         554.00    DIST       19.90                     DISC0792
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U50D5     U50          1.0    D5          1.0                 DISC0793
U50D5     POP5       554.00   DIST        8.65                DISC0794
U50D6     U50          1.0    D6          1.0                 DISC0795
U50D6     POP6       554.00   DIST       13.05                DISC0796
U50D7     U50          1.0    D7          1.0                 DISC0797
U50D7     POP7       554.00   DIST       28.76                DISC0798
U50D8     U50          1.0    D8          1.0                 DISC0799
U50D8     POP8       554.00   DIST       17.92                DISC0800
U51D1     U51          1.0    D1          1.0                 DISC0801
U51D1     POP1      3778.00   DIST       28.66                DISC0802
U51D2     U51          1.0    D2          1.0                 DISC0803
U51D2     POP2      3778.00   DIST       31.98                DISC0804
U51D3     U51          1.0    D3          1.0                 DISC0805
U51D3     POP3      3778.00   DIST       34.04                DISC0806
U51D4     U51          1.0    D4          1.0                 DISC0807
U51D4     POP4      3778.00   DIST       15.79                DISC0808
U51D5     U51          1.0    D5          1.0                 DISC0809
U51D5     POP5      3778.00   DIST        4.03                DISC0810
U51D6     U51          1.0    D6          1.0                 DISC0811
U51D6     POP6      3778.00   DIST       20.01                DISC0812
U51D7     U51          1.0    D7          1.0                 DISC0813
U51D7     POP7      3778.00   DIST       34.82                DISC0814
U51D8     U51          1.0    D8          1.0                 DISC0815
U51D8     POP8      3778.00   DIST       21.32                DISC0816
U52D1     U52          1.0    D1          1.0                 DISC0817
U52D1     POP1      2505.00   DIST       27.39                DISC0818
U52D2     U52          1.0    D2          1.0                 DISC0819
U52D2     POP2      2505.00   DIST       28.72                DISC0820
U52D3     U52          1.0    D3          1.0                 DISC0821
U52D3     POP3      2505.00   DIST       30.06                DISC0822
U52D4     U52          1.0    D4          1.0                 DISC0823
U52D4     POP4      2505.00   DIST       12.02                DISC0824
U52D5     U52          1.0    D5          1.0                 DISC0825
U52D5     POP5      2505.00   DIST        0.00                DISC0826
U52D6     U52          1.0    D6          1.0                 DISC0827
U52D6     POP6      2505.00   DIST       20.02                DISC0828
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U52D7     U52             1.0   D7              1.0                DISC0829
U52D7     POP7        2505.00   DIST          33.45                DISC0830
U52D8     U52             1.0   D8              1.0                DISC0831
U52D8     POP8        2505.00   DIST          18.61                DISC0832
U53D1     U53             1.0   D1              1.0                DISC0833
U53D1     POP1         420.00   DIST          34.36                DISC0834
U53D2     U53             1.0   D2              1.0                DISC0835
U53D2     POP2         420.00   DIST          34.51                DISC0836
U53D3     U53             1.0   D3              1.0                DISC0837
U53D3     POP3         420.00   DIST          33.59                DISC0838
U53D4     U53             1.0   D4              1.0                DISC0839
U53D4     POP4         420.00   DIST          17.20                DISC0840
U53D5     U53             1.0   D5              1.0                DISC0841
U53D5     POP5         420.00   DIST           6.97                DISC0842
U53D6     U53             1.0   D6              1.0                DISC0843
U53D6     POP6         420.00   DIST          13.16                DISC0844
U53D7     U53             1.0   D7              1.0                DISC0845
U53D7     POP7         420.00   DIST          27.68                DISC0846
U53D8     U53             1.0   D8              1.0                DISC0847
U53D8     POP8         420.00   DIST          15.31                DISC0848
U54D1     U54             1.0   D1              1.0                DISC0849
U54D1     POP1         400.00   DIST          32.76                DISC0850
U54D2     U54             1.0   D2              1.0                DISC0851
U54D2     POP2         400.00   DIST          31.51                DISC0852
U54D3     U54             1.0   D3              1.0                DISC0853
U54D3     POP3         400.00   DIST          30.08                DISC0854
U54D4     U54             1.0   D4              1.0                DISC0855
U54D4     POP4         400.00   DIST          14.15                DISC0856
U54D5     U54             1.0   D5              1.0                DISC0857
U54D5     POP5         400.00   DIST           6.09                DISC0858
U54D6     U54             1.0   D6              1.0                DISC0859
U54D6     POP6         400.00   DIST          14.58                DISC0860
U54D7     U54             1.0   D7              1.0                DISC0861
U54D7     POP7         400.00   DIST          27.37                DISC0862
U54D8     U54             1.0   D8              1.0                DISC0863
U54D8     POP8         400.00   DIST          13.12                DISC0864
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U55D1     U55            1.0     D1            1.0                     DISC0865
U55D1     POP1          99.00    DIST         26.08                    DISC0866
U55D2     U55            1.0     D2            1.0                     DISC0867
U55D2     POP2          99.00    DIST         24.99                    DISC0868
U55D3     U55            1.0     D3            1.0                     DISC0869
U55D3     POP3          99.00    DIST         25.57                    DISC0870
U55D4     U55            1.0     D4            1.0                     DISC0871
U55D4     POP4          99.00    DIST          7.82                    DISC0872
U55D5     U55            1.0     D5            1.0                     DISC0873
U55D5     POP5          99.00    DIST          4.50                    DISC0874
U55D6     U55            1.0     D6            1.0                     DISC0875
U55D6     POP6          99.00    DIST         21.48                    DISC0876
U55D7     U55            1.0     D7            1.0                     DISC0877
U55D7     POP7          99.00    DIST         33.02                    DISC0878
U55D8     U55            1.0     D8            1.0                     DISC0879
U55D8     POP8          99.00    DIST         16.77                    DISC0880
U56D1     U56            1.0     D1            1.0                     DISC0881
U56D1     POP1          78.00    DIST         25.08                    DISC0882
U56D2     U56            1.0     D2            1.0                     DISC0883
U56D2     POP2          78.00    DIST         19.14                    DISC0884
U56D3     U56            1.0     D3            1.0                     DISC0885
U56D3     POP3          78.00    DIST         18.06                    DISC0886
U56D4     U56            1.0     D4            1.0                     DISC0887
U56D4     POP4          78.00    DIST          3.04                    DISC0888
U56D5     U56            1.0     D5            1.0                     DISC0889
U56D5     POP5          78.00    DIST         12.01                    DISC0890
U56D6     U56            1.0     D6            1.0                     DISC0891
U56D6     POP6          78.00    DIST         25.93                    DISC0892
U56D7     U56            1.0     D7            1.0                     DISC0893
U56D7     POP7          78.00    DIST         34.13                    DISC0894
U56D8     U56            1.0     D8            1.0                     DISC0895
U56D8     POP8          78.00    DIST         16.69                    DISC0896
U57D1     U57            1.0     D1            1.0                     DISC0897
U57D1     POP1         687.00    DIST         27.54                    DISC0898
U57D2     U57            1.0     D2            1.0                     DISC0899
U57D2     POP2         687.00    DIST         21.40                    DISC0900
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U57D3     U57         1.0     D3          1.0                    DISC0901
U57D3     POP3      687.00    DIST       18.92                   DISC0902
U57D4     U57         1.0     D4          1.0                    DISC0903
U57D4     POP4      687.00    DIST        5.50                   DISC0904
U57D5     U57         1.0     D5          1.0                    DISC0905
U57D5     POP5      687.00    DIST       11.67                   DISC0906
U57D6     U57         1.0     D6          1.0                    DISC0907
U57D6     POP6      687.00    DIST       23.71                   DISC0908
U57D7     U57         1.0     D7          1.0                    DISC0909
U57D7     POP7      687.00    DIST       31.57                   DISC0910
U57D8     U57         1.0     D8          1.0                    DISC0911
U57D8     POP8      687.00    DIST       14.15                   DISC0912
U58D1     U58         1.0     D1          1.0                    DISC0913
U58D1     POP1     2886.00    DIST       28.02                   DISC0914
U58D2     U58         1.0     D2          1.0                    DISC0915
U58D2     POP2     2886.00    DIST       17.92                   DISC0916
U58D3     U58         1.0     D3          1.0                    DISC0917
U58D3     POP3     2886.00    DIST       12.98                   DISC0918
U58D4     U58         1.0     D4          1.0                    DISC0919
U58D4     POP4     2886.00    DIST        7.81                   DISC0920
U58D5     U58         1.0     D5          1.0                    DISC0921
U58D5     POP5     2886.00    DIST       17.56                   DISC0922
U58D6     U58         1.0     D6          1.0                    DISC0923
U58D6     POP6     2886.00    DIST       28.42                   DISC0924
U58D7     U58         1.0     D7          1.0                    DISC0925
U58D7     POP7     2886.00    DIST       33.71                   DISC0926
U58D8     U58         1.0     D8          1.0                    DISC0927
U58D8     POP8     2886.00    DIST       16.56                   DISC0928
U59D1     U59         1.0     D1          1.0                    DISC0929
U59D1     POP1     2028.00    DIST       30.21                   DISC0930
U59D2     U59         1.0     D2          1.0                    DISC0931
U59D2     POP2     2028.00    DIST       17.12                   DISC0932
U59D3     U59         1.0     D3          1.0                    DISC0933
U59D3     POP3     2028.00    DIST        8.50                   DISC0934
U59D4     U59         1.0     D4          1.0                    DISC0935
U59D4     POP4     2028.00    DIST       12.30                   DISC0936
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U59D5     U59          1.0   D5        1.0                    DISC0937
U59D5     POP5      2028.00  DIST     22.59                   DISC0938
U59D6     U59          1.0   D6        1.0                    DISC0939
U59D6     POP6      2028.00  DIST     32.17                   DISC0940
U59D7     U59          1.0   D7        1.0                    DISC0941
U59D7     POP7      2028.00  DIST     35.35                   DISC0942
U59D8     U59          1.0   D8        1.0                    DISC0943
U59D8     POP8      2028.00  DIST     19.11                   DISC0944
U60D1     U60          1.0   D1        1.0                    DISC0945
U60D1     POP1      2713.00  DIST     36.00                   DISC0946
U60D2     U60          1.0   D2        1.0                    DISC0947
U60D2     POP2      2713.00  DIST     21.59                   DISC0948
U60D3     U60          1.0   D3        1.0                    DISC0949
U60D3     POP3      2713.00  DIST      9.20                   DISC0950
U60D4     U60          1.0   D4        1.0                    DISC0951
U60D4     POP4      2713.00  DIST     18.03                   DISC0952
U60D5     U60          1.0   D5        1.0                    DISC0953
U60D5     POP5      2713.00  DIST     27.28                   DISC0954
U60D6     U60          1.0   D6        1.0                    DISC0955
U60D6     POP6      2713.00  DIST     33.61                   DISC0956
U60D7     U60          1.0   D7        1.0                    DISC0957
U60D7     POP7      2713.00  DIST     33.81                   DISC0958
U60D8     U60          1.0   D8        1.0                    DISC0959
U60D8     POP8      2713.00  DIST     19.47                   DISC0960
U61D1     U61          1.0   D1        1.0                    DISC0961
U61D1     POP1      1383.00  DIST     35.52                   DISC0962
U61D2     U61          1.0   D2        1.0                    DISC0963
U61D2     POP2      1383.00  DIST     19.45                   DISC0964
U61D3     U61          1.0   D3        1.0                    DISC0965
U61D3     POP3      1383.00  DIST      5.53                   DISC0966
U61D4     U61          1.0   D4        1.0                    DISC0967
U61D4     POP4      1383.00  DIST     20.25                   DISC0968
U61D5     U61          1.0   D5        1.0                    DISC0969
U61D5     POP5      1383.00  DIST     30.70                   DISC0970
U61D6     U61          1.0   D6        1.0                    DISC0971
U61D6     POP6      1383.00  DIST     38.49                   DISC0972
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U61D7     U61          1.0     D7            1.0                     DISC0973
U61D7     POP7      1383.00    DIST         38.67                    DISC0974
U61D8     U61          1.0     D8            1.0                     DISC0975
U61D8     POP8      1383.00    DIST         24.44                    DISC0976
U62D1     U62          1.0     D1            1.0                     DISC0977
U62D1     POP1       199.00    DIST         39.12                    DISC0978
U62D2     U62          1.0     D2            1.0                     DISC0979
U62D2     POP2       199.00    DIST         22.36                    DISC0980
U62D3     U62          1.0     D3            1.0                     DISC0981
U62D3     POP3       199.00    DIST          8.32                    DISC0982
U62D4     U62          1.0     D4            1.0                     DISC0983
U62D4     POP4       199.00    DIST         24.52                    DISC0984
U62D5     U62          1.0     D5            1.0                     DISC0985
U62D5     POP5       199.00    DIST         34.86                    DISC0986
U62D6     U62          1.0     D6            1.0                     DISC0987
U62D6     POP6       199.00    DIST         41.61                    DISC0988
U62D7     U62          1.0     D7            1.0                     DISC0989
U62D7     POP7       199.00    DIST         40.31                    DISC0990
U62D8     U62          1.0     D8            1.0                     DISC0991
U62D8     POP8       199.00    DIST         27.32                    DISC0992
U63D1     U63          1.0     D1            1.0                     DISC0993
U63D1     POP1        94.00    DIST         41.61                    DISC0994
U63D2     U63          1.0     D2            1.0                     DISC0995
U63D2     POP2        94.00    DIST         25.78                    DISC0996
U63D3     U63          1.0     D3            1.0                     DISC0997
U63D3     POP3        94.00    DIST         11.78                    DISC0998
U63D4     U63          1.0     D4            1.0                     DISC0999
U63D4     POP4        94.00    DIST         24.70                    DISC1000
U63D5     U63          1.0     D5            1.0                     DISC1001
U63D5     POP5        94.00    DIST         33.86                    DISC1002
U63D6     U63          1.0     D6            1.0                     DISC1003
U63D6     POP6        94.00    DIST         38.33                    DISC1004
U63D7     U63          1.0     D7            1.0                     DISC1005
U63D7     POP7        94.00    DIST         35.79                    DISC1006
U63D8     U63          1.0     D8            1.0                     DISC1007
U63D8     POP8        94.00    DIST         23.90                    DISC1008
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U64D1     U64        1.0     D1         1.0                      DISC1009
U64D1     POP1     101.00    DIST      42.50                     DISC1010
U64D2     U64        1.0     D2         1.0                      DISC1011
U64D2     POP2     101.00    DIST      28.22                     DISC1012
U64D3     U64        1.0     D3         1.0                      DISC1013
U64D3     POP3     101.00    DIST      15.14                     DISC1014
U64D4     U64        1.0     D4         1.0                      DISC1015
U64D4     POP4     101.00    DIST      23.34                     DISC1016
U64D5     U64        1.0     D5         1.0                      DISC1017
U64D5     POP5     101.00    DIST      30.87                     DISC1018
U64D6     U64        1.0     D6         1.0                      DISC1019
U64D6     POP6     101.00    DIST      33.14                     DISC1020
U64D7     U64        1.0     D7         1.0                      DISC1021
U64D7     POP7     101.00    DIST      30.10                     DISC1022
U64D8     U64        1.0     D8         1.0                      DISC1023
U64D8     POP8     101.00    DIST      18.74                     DISC1024
U65D1     U65        1.0     D1         1.0                      DISC1025
U65D1     POP1    2522.00    DIST      36.70                     DISC1026
U65D2     U65        1.0     D2         1.0                      DISC1027
U65D2     POP2    2522.00    DIST      24.08                     DISC1028
U65D3     U65        1.0     D3         1.0                      DISC1029
U65D3     POP3    2522.00    DIST      13.32                     DISC1030
U65D4     U65        1.0     D4         1.0                      DISC1031
U65D4     POP4    2522.00    DIST      16.65                     DISC1032
U65D5     U65        1.0     D5         1.0                      DISC1033
U65D5     POP5    2522.00    DIST      24.23                     DISC1034
U65D6     U65        1.0     D6         1.0                      DISC1035
U65D6     POP6    2522.00    DIST      28.97                     DISC1036
U65D7     U65        1.0     D7         1.0                      DISC1037
U65D7     POP7    2522.00    DIST      29.41                     DISC1038
U65D8     U65        1.0     D8         1.0                      DISC1039
U65D8     POP8    2522.00    DIST      14.77                     DISC1040
U66D1     U66        1.0     D1         1.0                      DISC1041
U66D1     POP1    2142.00    DIST      43.01                     DISC1042
U66D2     U66        1.0     D2         1.0                      DISC1043
U66D2     POP2    2142.00    DIST      30.53                     DISC1044
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 U66D3     U66              1.0     D3             1.0                        DISC1045
 U66D3     POP3          2142.00    DIST          18.85                       DISC1046
 U66D4     U66              1.0     D4             1.0                        DISC1047
 U66D4     POP4          2142.00    DIST          22.21                       DISC1048
 U66D5     U66              1.0     D5             1.0                        DISC1049
 U66D5     POP5          2142.00    DIST          27.74                       DISC1050
 U66D6     U66              1.0     D6             1.0                        DISC1051
 U66D6     POP6          2142.00    DIST          27.79                       DISC1052
 U66D7     U66              1.0     D7             1.0                        DISC1053
 U66D7     POP7          2142.00    DIST          24.75                       DISC1054
 U66D8     U66              1.0     D8             1.0                        DISC1055
 U66D8     POP8          2142.00    DIST          13.51                       DISC1056
 U67D1     U67              1.0     D1             1.0                        DISC1057
 U67D1     POP1          1155.00    DIST          38.51                       DISC1058
 U67D2     U67              1.0     D2             1.0                        DISC1059
 U67D2     POP2          1155.00    DIST          31.08                       DISC1060
 U67D3     U67              1.0     D3             1.0                        DISC1061
 U67D3     POP3          1155.00    DIST          24.20                       DISC1062
 U67D4     U67              1.0     D4             1.0                        DISC1063
 U67D4     POP4          1155.00    DIST          16.50                       DISC1064
 U67D5     U67              1.0     D5             1.0                        DISC1065
 U67D5     POP5          1155.00    DIST          17.03                       DISC1066
 U67D6     U67              1.0     D6             1.0                        DISC1067
 U67D6     POP6          1155.00    DIST          16.81                       DISC1068
 U67D7     U67              1.0     D7             1.0                        DISC1069
 U67D7     POP7          1155.00    DIST          20.74                       DISC1070
 U67D8     U67              1.0     D8             1.0                        DISC1071
 U67D8     POP8          1155.00    DIST           3.36                       DISC1072
 U68D1     U68              1.0     D1             1.0                        DISC1073
 U68D1     POP1          2742.00    DIST          35.73                       DISC1074
 U68D2     U68              1.0     D2             1.0                        DISC1075
 U68D2     POP2          2742.00    DIST          27.11                       DISC1076
 U68D3     U68              1.0     D3             1.0                        DISC1077
 U68D3     POP3          2742.00    DIST          20.00                       DISC1078
 U68D4     U68              1.0     D4             1.0                        DISC1079
 U68D4     POP4          2742.00    DIST          13.73                       DISC1080
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U68D5     U68            1.0     D5           1.0                      DISC1081
U68D5     POP5        2742.00    DIST        17.21                     DISC1082
U68D6     U68            1.0     D6           1.0                      DISC1083
U68D6     POP6        2742.00    DIST        20.80                     DISC1084
U68D7     U68            1.0     D7           1.0                      DISC1085
U68D7     POP7        2742.00    DIST        24.52                     DISC1086
U68D8     U68            1.0     D8           1.0                      DISC1087
U68D8     POP8        2742.00    DIST         7.50                     DISC1088
U69D1     U69            1.0     D1           1.0                      DISC1089
U69D1     POP1         678.00    DIST        31.51                     DISC1090
U69D2     U69            1.0     D2           1.0                      DISC1091
U69D2     POP2         678.00    DIST        24.96                     DISC1092
U69D3     U69            1.0     D3           1.0                      DISC1093
U69D3     POP3         678.00    DIST        20.62                     DISC1094
U69D4     U69            1.0     D4           1.0                      DISC1095
U69D4     POP4         678.00    DIST         9.51                     DISC1096
U69D5     U69            1.0     D5           1.0                      DISC1097
U69D5     POP5         678.00    DIST        12.52                     DISC1098
U69D6     U69            1.0     D6           1.0                      DISC1099
U69D6     POP6         678.00    DIST        20.55                     DISC1100
U69D7     U69            1.0     D7           1.0                      DISC1101
U69D7     POP7         678.00    DIST        27.55                     DISC1102
U69D8     U69            1.0     D8           1.0                      DISC1103
U69D8     POP8         678.00    DIST        10.12                     DISC1104
U70D1     U70            1.0     D1           1.0                      DISC1105
U70D1     POP1        3396.00    DIST        36.88                     DISC1106
U70D2     U70            1.0     D2           1.0                      DISC1107
U70D2     POP2        3396.00    DIST        34.00                     DISC1108
U70D3     U70            1.0     D3           1.0                      DISC1109
U70D3     POP3        3396.00    DIST        30.66                     DISC1110
U70D4     U70            1.0     D4           1.0                      DISC1111
U70D4     POP4        3396.00    DIST        16.92                     DISC1112
U70D5     U70            1.0     D5           1.0                      DISC1113
U70D5     POP5        3396.00    DIST        10.69                     DISC1114
U70D6     U70            1.0     D6           1.0                      DISC1115
U70D6     POP6        3396.00    DIST        11.10                     DISC1116
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    U70D7     U70            1.0     D7              1.0                        DISC1117
    U70D7     POP7       3396.00     DIST           22.76                       DISC1118
    U70D8     U70            1.0     D8              1.0                        DISC1119
    U70D8     POP8       3396.00     DIST            9.30                       DISC1120
    U71D1     U71            1.0     D1              1.0                        DISC1121
    U71D1     POP1       1881.00     DIST           46.10                       DISC1122
    U71D2     U71            1.0     D2              1.0                        DISC1123
    U71D2     POP2       1881.00     DIST           45.98                       DISC1124
    U71D3     U71            1.0     D3              1.0                        DISC1125
    U71D3     POP3       1881.00     DIST           43.16                       DISC1126
    U71D4     U71            1.0     D4              1.0                        DISC1127
    U71D4     POP4       1881.00     DIST           28.64                       DISC1128
    U71D5     U71            1.0     D5              1.0                        DISC1129
    U71D5     POP5       1881.00     DIST           18.80                       DISC1130
    U71D6     U71            1.0     D6              1.0                        DISC1131
    U71D6     POP6       1881.00     DIST            5.41                       DISC1132
    U71D7     U71            1.0     D7              1.0                        DISC1133
    U71D7     POP7       1881.00     DIST           21.96                       DISC1134
    U71D8     U71            1.0     D8              1.0                        DISC1135
    U71D8     POP8       1881.00     DIST           18.50                       DISC1136
    U72D1     U72            1.0     D1              1.0                        DISC1137
    U72D1     POP1       2807.00     DIST           47.28                       DISC1138
    U72D2     U72            1.0     D2              1.0                        DISC1139
    U72D2     POP2       2807.00     DIST           45.07                       DISC1140
    U72D3     U72            1.0     D3              1.0                        DISC1141
    U72D3     POP3       2807.00     DIST           40.65                       DISC1142
    U72D4     U72            1.0     D4              1.0                        DISC1143
    U72D4     POP4       2807.00     DIST           28.02                       DISC1144
    U72D5     U72            1.0     D5              1.0                        DISC1145
    U72D5     POP5       2807.00     DIST           20.02                       DISC1146
    U72D6     U72            1.0     D6              1.0                        DISC1147
    U72D6     POP6       2807.00     DIST            0.00                       DISC1148
    U72D7     U72            1.0     D7              1.0                        DISC1149
    U72D7     POP7       2807.00     DIST           16.79                       DISC1150
    U72D8     U72            1.0     D8              1.0                        DISC1151
    U72D8     POP8       2807.00     DIST           14.43                       DISC1152
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U73D1    U73          1.0   D1          1.0                DISC1153
U73D1    POP1       101.00  DIST       45.72               DISC1154
U73D2    U73          1.0   D2          1.0                DISC1155
U73D2    POP2       101.00  DIST       42.19               DISC1156
U73D3    U73          1.0   D3          1.0                DISC1157
U73D3    POP3       101.00  DIST       37.03               DISC1158
U73D4    U73          1.0   D4          1.0                DISC1159
U73D4    POP4       101.00  DIST       25.49               DISC1160
U73D5    U73          1.0   D5          1.0                DISC1161
U73D5    POP5       101.00  DIST       19.00               DISC1162
U73D6    U73          1.0   D6          1.0                DISC1163
U73D6    POP6       101.00  DIST        4.03               DISC1164
U73D7    U73          1.0   D7          1.0                DISC1165
U73D7    POP7       101.00  DIST       15.23               DISC1166
U73D8    U73          1.0   D8          1.0                DISC1167
U73D8    POP8       101.00  DIST       10.43               DISC1168
U74D1    U74          1.0   D1          1.0                DISC1169
U74D1    POP1       103.00  DIST       45.62               DISC1170
U74D2    U74          1.0   D2          1.0                DISC1171
U74D2    POP2       103.00  DIST       40.91               DISC1172
U74D3    U74          1.0   D3          1.0                DISC1173
U74D3    POP3       103.00  DIST       34.90               DISC1174
U74D4    U74          1.0   D4          1.0                DISC1175
U74D4    POP4       103.00  DIST       24.69               DISC1176
U74D5    U74          1.0   D5          1.0                DISC1177
U74D5    POP5       103.00  DIST       19.66               DISC1178
U74D6    U74          1.0   D6          1.0                DISC1179
U74D6    POP6       103.00  DIST        7.00               DISC1180
U74D7    U74          1.0   D7          1.0                DISC1181
U74D7    POP7       103.00  DIST       13.83               DISC1182
U74D8    U74          1.0   D8          1.0                DISC1183
U74D8    POP8       103.00  DIST        7.82               DISC1184
U75D1    U75          1.0   D1          1.0                DISC1185
U75D1    POP1       114.00  DIST       53.29               DISC1186
U75D2    U75          1.0   D2          1.0                DISC1187
U75D2    POP2       114.00  DIST       50.91               DISC1188
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U75D3     U75             1.0    D3           1.0                      DISC1189
U75D3     POP3          114.00   DIST        45.81                     DISC1190
U75D4     U75             1.0    D4           1.0                      DISC1191
U75D4     POP4          114.00   DIST        33.98                     DISC1192
U75D5     U75             1.0    D5           1.0                      DISC1193
U75D5     POP5          114.00   DIST        25.97                     DISC1194
U75D6     U75             1.0    D6           1.0                      DISC1195
U75D6     POP6          114.00   DIST         6.04                     DISC1196
U75D7     U75             1.0    D7           1.0                      DISC1197
U75D7     POP7          114.00   DIST        14.84                     DISC1198
U75D8     U75             1.0    D8           1.0                      DISC1199
U75D8     POP8          114.00   DIST        18.80                     DISC1200
U76D1     U76             1.0    D1           1.0                      DISC1201
U76D1     POP1          821.00   DIST        56.95                     DISC1202
U76D2     U76             1.0    D2           1.0                      DISC1203
U76D2     POP2          821.00   DIST        53.82                     DISC1204
U76D3     U76             1.0    D3           1.0                      DISC1205
U76D3     POP3          821.00   DIST        47.89                     DISC1206
U76D4     U76             1.0    D4           1.0                      DISC1207
U76D4     POP4          821.00   DIST        37.15                     DISC1208
U76D5     U76             1.0    D5           1.0                      DISC1209
U76D5     POP5          821.00   DIST        29.72                     DISC1210
U76D6     U76             1.0    D6           1.0                      DISC1211
U76D6     POP6          821.00   DIST         9.71                     DISC1212
U76D7     U76             1.0    D7           1.0                      DISC1213
U76D7     POP7          821.00   DIST        12.64                     DISC1214
U76D8     U76             1.0    D8           1.0                      DISC1215
U76D8     POP8          821.00   DIST        20.61                     DISC1216
U77D1     U77             1.0    D1           1.0                      DISC1217
U77D1     POP1          930.00   DIST        55.30                     DISC1218
U77D2     U77             1.0    D2           1.0                      DISC1219
U77D2     POP2          930.00   DIST        51.58                     DISC1220
U77D3     U77             1.0    D3           1.0                      DISC1221
U77D3     POP3          930.00   DIST        45.34                     DISC1222
U77D4     U77             1.0    D4           1.0                      DISC1223
U77D4     POP4          930.00   DIST        35.10                     DISC1224
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U77D5    U77        1.0    D5       1.0          DISC1225
U77D5    POP5     930.00   DIST    28.29         DISC1226
U77D6    U77        1.0    D6       1.0          DISC1227
U77D6    POP6     930.00   DIST     8.51         DISC1228
U77D7    U77        1.0    D7       1.0          DISC1229
U77D7    POP7     930.00   DIST    10.73         DISC1230
U77D8    U77        1.0    D8       1.0          DISC1231
U77D8    POP8     930.00   DIST    18.06         DISC1232
U78D1    U78        1.0    D1       1.0          DISC1233
U78D1    POP1     786.00   DIST    51.88         DISC1234
U78D2    U78        1.0    D2       1.0          DISC1235
U78D2    POP2     786.00   DIST    47.07         DISC1236
U78D3    U78        1.0    D3       1.0          DISC1237
U78D3    POP3     786.00   DIST    40.33         DISC1238
U78D4    U78        1.0    D4       1.0          DISC1239
U78D4    POP4     786.00   DIST    31.01         DISC1240
U78D5    U78        1.0    D5       1.0          DISC1241
U78D5    POP5     786.00   DIST    25.51         DISC1242
U78D6    U78        1.0    D6       1.0          DISC1243
U78D6    POP6     786.00   DIST     7.80         DISC1244
U78D7    U78        1.0    D7       1.0          DISC1245
U78D7    POP7     786.00   DIST     9.01         DISC1246
U78D8    U78        1.0    D8       1.0          DISC1247
U78D8    POP8     786.00   DIST    13.08         DISC1248
U79D1    U79        1.0    D1       1.0          DISC1249
U79D1    POP1     678.00   DIST    54.43         DISC1250
U79D2    U79        1.0    D2       1.0          DISC1251
U79D2    POP2     678.00   DIST    49.49         DISC1252
U79D3    U79        1.0    D3       1.0          DISC1253
U79D3    POP3     678.00   DIST    42.43         DISC1254
U79D4    U79        1.0    D4       1.0          DISC1255
U79D4    POP4     678.00   DIST    33.53         DISC1256
U79D5    U79        1.0    D5       1.0          DISC1257
U79D5    POP5     678.00   DIST    28.00         DISC1258
U79D6    U79        1.0    D6       1.0          DISC1259
U79D6    POP6     678.00   DIST     9.61         DISC1260
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U79D7    U79         1.0     D7          1.0          DISC1261
U79D7    POP7      678.00    DIST        7.43         DISC1262
U79D8    U79         1.0     D8          1.0          DISC1263
U79D8    POP8      678.00    DIST       15.31         DISC1264
U80D1    U80         1.0     D1          1.0          DISC1265
U80D1    POP1     1037.00    DIST       56.59         DISC1266
U80D2    U80         1.0     D2          1.0          DISC1267
U80D2    POP2     1037.00    DIST       51.73         DISC1268
U80D3    U80         1.0     D3          1.0          DISC1269
U80D3    POP3     1037.00    DIST       44.56         DISC1270
U80D4    U80         1.0     D4          1.0          DISC1271
U80D4    POP4     1037.00    DIST       35.76         DISC1272
U80D5    U80         1.0     D5          1.0          DISC1273
U80D5    POP5     1037.00    DIST       30.02         DISC1274
U80D6    U80         1.0     D6          1.0          DISC1275
U80D6    POP6     1037.00    DIST       11.07         DISC1276
U80D7    U80         1.0     D7          1.0          DISC1277
U80D7    POP7     1037.00    DIST        7.15         DISC1278
U80D8    U80         1.0     D8          1.0          DISC1279
U80D8    POP8     1037.00    DIST       17.50         DISC1280
U81D1    U81         1.0     D1          1.0          DISC1281
U81D1    POP1     1287.00    DIST       58.67         DISC1282
U81D2    U81         1.0     D2          1.0          DISC1283
U81D2    POP2     1287.00    DIST       51.62         DISC1284
U81D3    U81         1.0     D3          1.0          DISC1285
U81D3    POP3     1287.00    DIST       42.72         DISC1286
U81D4    U81         1.0     D4          1.0          DISC1287
U81D4    POP4     1287.00    DIST       36.98         DISC1288
U81D5    U81         1.0     D5          1.0          DISC1289
U81D5    POP5     1287.00    DIST       33.45         DISC1290
U81D6    U81         1.0     D6          1.0          DISC1291
U81D6    POP6     1287.00    DIST       16.79         DISC1292
U81D7    U81         1.0     D7          1.0          DISC1293
U81D7    POP7     1287.00    DIST        0.00         DISC1294
U81D8    U81         1.0     D8          1.0          DISC1295
U81D8    POP8     1287.00    DIST       17.46         DISC1296
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U82D1     U82          1.0   D1          1.0                     DISC1297
U82D1     POP1      1772.00  DIST       55.62                    DISC1298
U82D2     U82          1.0   D2          1.0                     DISC1299
U82D2     POP2      1772.00  DIST       48.47                    DISC1300
U82D3     U82          1.0   D3          1.0                     DISC1301
U82D3     POP3      1772.00  DIST       39.71                    DISC1302
U82D4     U82          1.0   D4          1.0                     DISC1303
U82D4     POP4      1772.00  DIST       33.87                    DISC1304
U82D5     U82          1.0   D5          1.0                     DISC1305
U82D5     POP5      1772.00  DIST       30.70                    DISC1306
U82D6     U82          1.0   D6          1.0                     DISC1307
U82D6     POP6      1772.00  DIST       15.20                    DISC1308
U82D7     U82          1.0   D7          1.0                     DISC1309
U82D7     POP7      1772.00  DIST        3.15                    DISC1310
U82D8     U82          1.0   D8          1.0                     DISC1311
U82D8     POP8      1772.00  DIST       14.32                    DISC1312
U83D1     U83          1.0   D1          1.0                     DISC1313
U83D1     POP1      1481.00  DIST       52.52                    DISC1314
U83D2     U83          1.0   D2          1.0                     DISC1315
U83D2     POP2      1481.00  DIST       44.94                    DISC1316
U83D3     U83          1.0   D3          1.0                     DISC1317
U83D3     POP3      1481.00  DIST       36.10                    DISC1318
U83D4     U83          1.0   D4          1.0                     DISC1319
U83D4     POP4      1481.00  DIST       30.65                    DISC1320
U83D5     U83          1.0   D5          1.0                     DISC1321
U83D5     POP5      1481.00  DIST       28.31                    DISC1322
U83D6     U83          1.0   D6          1.0                     DISC1323
U83D6     POP6      1481.00  DIST       15.01                    DISC1324
U83D7     U83          1.0   D7          1.0                     DISC1325
U83D7     POP7      1481.00  DIST        6.71                    DISC1326
U83D8     U83          1.0   D8          1.0                     DISC1327
U83D8     POP8      1481.00  DIST       11.04                    DISC1328
U84D1     U84          1.0   D1          1.0                     DISC1329
U84D1     POP1      1880.00  DIST       47.17                    DISC1330
U84D2     U84          1.0   D2          1.0                     DISC1331
U84D2     POP2      1880.00  DIST       40.92                    DISC1332
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U84D3     U84          1.0     D3          1.0                  DISC1333
U84D3     POP3      1880.00    DIST       33.59                 DISC1334
U84D4     U84          1.0     D4          1.0                  DISC1335
U84D4     POP4      1880.00    DIST       25.60                 DISC1336
U84D5     U84          1.0     D5          1.0                  DISC1337
U84D5     POP5      1880.00    DIST       22.32                 DISC1338
U84D6     U84          1.0     D6          1.0                  DISC1339
U84D6     POP6      1880.00    DIST       10.68                 DISC1340
U84D7     U84          1.0     D7          1.0                  DISC1341
U84D7     POP7      1880.00    DIST       11.51                 DISC1342
U84D8     U84          1.0     D8          1.0                  DISC1343
U84D8     POP8      1880.00    DIST        6.52                 DISC1344
U85D1     U85          1.0     D1          1.0                  DISC1345
U85D1     POP1      3731.00    DIST       41.51                 DISC1346
U85D2     U85          1.0     D2          1.0                  DISC1347
U85D2     POP2      3731.00    DIST       34.44                 DISC1348
U85D3     U85          1.0     D3          1.0                  DISC1349
U85D3     POP3      3731.00    DIST       27.28                 DISC1350
U85D4     U85          1.0     D4          1.0                  DISC1351
U85D4     POP4      3731.00    DIST       19.60                 DISC1352
U85D5     U85          1.0     D5          1.0                  DISC1353
U85D5     POP5      3731.00    DIST       18.61                 DISC1354
U85D6     U85          1.0     D6          1.0                  DISC1355
U85D6     POP6      3731.00    DIST       14.43                 DISC1356
U85D7     U85          1.0     D7          1.0                  DISC1357
U85D7     POP7      3731.00    DIST       17.46                 DISC1358
U85D8     U85          1.0     D8          1.0                  DISC1359
U85D8     POP8      3731.00    DIST        0.00                 DISC1360
U86D1     U86          1.0     D1          1.0                  DISC1361
U86D1     POP1      3865.00    DIST       48.27                 DISC1362
U86D2     U86          1.0     D2          1.0                  DISC1363
U86D2     POP2      3865.00    DIST       36.66                 DISC1364
U86D3     U86          1.0     D3          1.0                  DISC1365
U86D3     POP3      3865.00    DIST       25.17                 DISC1366
U86D4     U86          1.0     D4          1.0                  DISC1367
U86D4     POP4      3865.00    DIST       26.74                 DISC1368
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    U86D5      U86              1.0    D5              1.0                        DISC1369
    U86D5      POP5          3865.00   DIST           30.05                       DISC1370
    U86D6      U86              1.0    D6              1.0                        DISC1371
    U86D6      POP6          3865.00   DIST           25.57                       DISC1372
    U86D7      U86              1.0    D7              1.0                        DISC1373
    U86D7      POP7          3865.00   DIST           19.30                       DISC1374
    U86D8      U86              1.0    D8              1.0                        DISC1375
    U86D8      POP8          3865.00   DIST           12.75                       DISC1376
    U87D1      U87              1.0    D1              1.0                        DISC1377
    U87D1      POP1          2755.00   DIST           49.81                       DISC1378
    U87D2      U87              1.0    D2              1.0                        DISC1379
    U87D2      POP2          2755.00   DIST           40.03                       DISC1380
    U87D3      U87              1.0    D3              1.0                        DISC1381
    U87D3      POP3          2755.00   DIST           29.78                       DISC1382
    U87D4      U87              1.0    D4              1.0                        DISC1383
    U87D4      POP4          2755.00   DIST           27.79                       DISC1384
    U87D5      U87              1.0    D5              1.0                        DISC1385
    U87D5      POP5          2755.00   DIST           28.57                       DISC1386
    U87D6      U87              1.0    D6              1.0                        DISC1387
    U87D6      POP6          2755.00   DIST           20.49                       DISC1388
    U87D7      U87              1.0    D7              1.0                        DISC1389
    U87D7      POP7          2755.00   DIST           13.45                       DISC1390
    U87D8      U87              1.0    D8              1.0                        DISC1391
    U87D8      POP8          2755.00   DIST           10.00                       DISC1392
    U88D1      U88              1.0    D1              1.0                        DISC1393
    U88D1      POP1          3456.00   DIST           51.06                       DISC1394
    U88D2      U88              1.0    D2              1.0                        DISC1395
    U88D2      POP2          3456.00   DIST           42.23                       DISC1396
    U88D3      U88              1.0    D3              1.0                        DISC1397
    U88D3      POP3          3456.00   DIST           32.59                       DISC1398
    U88D4      U88              1.0    D4              1.0                        DISC1399
    U88D4      POP4          3456.00   DIST           29.01                       DISC1400
    U88D5      U88              1.0    D5              1.0                        DISC1401
    U88D5      POP5          3456.00   DIST           28.40                       DISC1402
    U88D6      U88              1.0    D6              1.0                        DISC1403
    U88D6      POP6          3456.00   DIST           18.02                       DISC1404
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U88D7     U88          1.0   D7          1.0            DISC1405
U88D7     POP7      3456.00  DIST       10.26           DISC1406
U88D8     U88          1.0   D8          1.0            DISC1407
U88D8     POP8      3456.00  DIST        9.96           DISC1408
U89D1     U89          1.0   D1          1.0            DISC1409
U89D1     POP1      1720.00  DIST       57.77           DISC1410
U89D2     U89          1.0   D2          1.0            DISC1411
U89D2     POP2      1720.00  DIST       47.85           DISC1412
U89D3     U89          1.0   D3          1.0            DISC1413
U89D3     POP3      1720.00  DIST       36.97           DISC1414
U89D4     U89          1.0   D4          1.0            DISC1415
U89D4     POP4      1720.00  DIST       35.73           DISC1416
U89D5     U89          1.0   D5          1.0            DISC1417
U89D5     POP5      1720.00  DIST       35.56           DISC1418
U89D6     U89          1.0   D6          1.0            DISC1419
U89D6     POP6      1720.00  DIST       23.58           DISC1420
U89D7     U89          1.0   D7          1.0            DISC1421
U89D7     POP7      1720.00  DIST       10.05           DISC1422
U89D8     U89          1.0   D8          1.0            DISC1423
U89D8     POP8      1720.00  DIST       17.09           DISC1424
U90D1     U90          1.0   D1          1.0            DISC1425
U90D1     POP1       855.00  DIST       59.63           DISC1426
U90D2     U90          1.0   D2          1.0            DISC1427
U90D2     POP2       855.00  DIST       50.11           DISC1428
U90D3     U90          1.0   D3          1.0            DISC1429
U90D3     POP3       855.00  DIST       39.40           DISC1430
U90D4     U90          1.0   D4          1.0            DISC1431
U90D4     POP4       855.00  DIST       37.58           DISC1432
U90D5     U90          1.0   D5          1.0            DISC1433
U90D5     POP5       855.00  DIST       36.77           DISC1434
U90D6     U90          1.0   D6          1.0            DISC1435
U90D6     POP6       855.00  DIST       23.50           DISC1436
U90D7     U90          1.0   D7          1.0            DISC1437
U90D7     POP7       855.00  DIST        8.56           DISC1438
U90D8     U90          1.0   D8          1.0            DISC1439
U90D8     POP8       855.00  DIST       18.55           DISC1440
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U91D1     U91          1.0    D1           1.0                     DISC1441
U91D1     POP1       699.00   DIST        61.03                    DISC1442
U91D2     U91          1.0    D2           1.0                     DISC1443
U91D2     POP2       699.00   DIST        52.02                    DISC1444
U91D3     U91          1.0    D3           1.0                     DISC1445
U91D3     POP3       699.00   DIST        41.60                    DISC1446
U91D4     U91          1.0    D4           1.0                     DISC1447
U91D4     POP4       699.00   DIST        39.00                    DISC1448
U91D5     U91          1.0    D5           1.0                     DISC1449
U91D5     POP5       699.00   DIST        37.47                    DISC1450
U91D6     U91          1.0    D6           1.0                     DISC1451
U91D6     POP6       699.00   DIST        22.98                    DISC1452
U91D7     U91          1.0    D7           1.0                     DISC1453
U91D7     POP7       699.00   DIST         6.97                    DISC1454
U91D8     U91          1.0    D8           1.0                     DISC1455
U91D8     POP8       699.00   DIST        19.66                    DISC1456
U92D1     U92          1.0    D1           1.0                     DISC1457
U92D1     POP1      2209.00   DIST        61.74                    DISC1458
U92D2     U92          1.0    D2           1.0                     DISC1459
U92D2     POP2      2209.00   DIST        54.78                    DISC1460
U92D3     U92          1.0    D3           1.0                     DISC1461
U92D3     POP3      2209.00   DIST        45.76                    DISC1462
U92D4     U92          1.0    D4           1.0                     DISC1463
U92D4     POP4      2209.00   DIST        40.11                    DISC1464
U92D5     U92          1.0    D5           1.0                     DISC1465
U92D5     POP5      2209.00   DIST        36.28                    DISC1466
U92D6     U92          1.0    D6           1.0                     DISC1467
U92D6     POP6      2209.00   DIST        18.79                    DISC1468
U92D7     U92          1.0    D7           1.0                     DISC1469
U92D7     POP7      2209.00   DIST         3.16                    DISC1470
U92D8     U92          1.0    D8           1.0                     DISC1471
U92D8     POP8      2209.00   DIST        20.61                    DISC1472
U93D1     U93          1.0    D1           1.0                     DISC1473
U93D1     POP1       898.00   DIST        65.00                    DISC1474
U93D2     U93          1.0    D2           1.0                     DISC1475
U93D2     POP2       898.00   DIST        58.50                    DISC1476
```

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U93D3     U93          1.0   D3          1.0              DISC1477
U93D3     POP3       898.00  DIST       49.65             DISC1478
U93D4     U93          1.0   D4          1.0              DISC1479
U93D4     POP4       898.00  DIST       43.55             DISC1480
U93D5     U93          1.0   D5          1.0              DISC1481
U93D5     POP5       898.00  DIST       39.06             DISC1482
U93D6     U93          1.0   D6          1.0              DISC1483
U93D6     POP6       898.00  DIST       20.55             DISC1484
U93D7     U93          1.0   D7          1.0              DISC1485
U93D7     POP7       898.00  DIST        6.95             DISC1486
U93D8     U93          1.0   D8          1.0              DISC1487
U93D8     POP8       898.00  DIST       24.19             DISC1488
```

```
RHS
    RHS       U1             1.0                                      RHS 0001
    RHS       U2            1.0       U3            1.0               RHS 0002
    RHS       U4            1.0       U5            1.0               RHS 0003
    RHS       U6            1.0       U7            1.0               RHS 0004
    RHS       U8            1.0       U9            1.0               RHS 0005
    RHS       U10           1.0       U11           1.0               RHS 0006
    RHS       U12           1.0       U13           1.0               RHS 0007
    RHS       U14           1.0       U15           1.0               RHS 0008
    RHS       U16           1.0       U17           1.0               RHS 0009
    RHS       U18           1.0       U19           1.0               RHS 0010
    RHS       U20           1.0       U21           1.0               RHS 0011
    RHS       U22           1.0       U23           1.0               RHS 0012
    RHS       U24           1.0       U25           1.0               RHS 0013
    RHS       U26           1.0       U27           1.0               RHS 0014
    RHS       U28           1.0       U29           1.0               RHS 0015
    RHS       U30           1.0       U31           1.0               RHS 0016
    RHS       U32           1.0       U33           1.0               RHS 0017
    RHS       U34           1.0       U35           1.0               RHS 0018
    RHS       U36           1.0       U37           1.0               RHS 0019
    RHS       U38           1.0       U39           1.0               RHS 0020
    RHS       U40           1.0       U41           1.0               RHS 0021
    RHS       U42           1.0       U43           1.0               RHS 0022
    RHS       U44           1.0       U45           1.0               RHS 0023
    RHS       U46           1.0       U47           1.0               RHS 0024
    RHS       U48           1.0       U49           1.0               RHS 0025
    RHS       U50           1.0       U51           1.0               RHS 0026
    RHS       U52           1.0       U53           1.0               RHS 0027
    RHS       U54           1.0       U55           1.0               RHS 0028
    RHS       U56           1.0       U57           1.0               RHS 0029
    RHS       U58           1.0       U59           1.0               RHS 0030
    RHS       U60           1.0       U61           1.0               RHS 0031
    RHS       U62           1.0       U63           1.0               RHS 0032
    RHS       U64           1.0       U65           1.0               RHS 0033
    RHS       U66           1.0       U67           1.0               RHS 0034
    RHS       U68           1.0       U69           1.0               RHS 0035
                                                                      RHS 0036
RHS       U70            1.0   U71         1.0                 RHS  0037
RHS       U72            1.0   U73         1.0                 RHS  0038
RHS       U74            1.0   U75         1.0                 RHS  0039
RHS       U76            1.0   U77         1.0                 RHS  0040
RHS       U78            1.0   U79         1.0                 RHS  0041
RHS       U80            1.0   U81         1.0                 RHS  0042
RHS       U82            1.0   U83         1.0                 RHS  0043
RHS       U84            1.0   U85         1.0                 RHS  0044
RHS       U86            1.0   U87         1.0                 RHS  0045
RHS       U88            1.0   U89         1.0                 RHS  0046
RHS       U90            1.0   U91         1.0                 RHS  0047
RHS       U92            1.0   U93         1.0                 RHS  0048
RHS       D1             21.   D2          13.                 RHS  0049
RHS       D3             10.   D4           8.                 RHS  0050
RHS       D6             12.   D5          15.                 RHS  0051
RHS       D7              9.   D8           5.                 RHS  0052
                                                               RHS  0053
```

## V. The Aggregation Problem and Model

The aggregation problem also has two objectives: maximize the compactness of the daily collection areas and minimize the wasted travel time involved in going from districts in one day to districts in the next. The daily area problem, though, is not basically an analytical one. Natural boundaries such as major streets are usually chosen, for various reasons, and the set of acceptable plans is small. Various plans can be generated by normal districting methods.

Given a plan, though, optimization of the weekly routes is easy. The transportation problem describes the problem of moving trucks from one day's districts to the next, with each old district as a source and each new one a sink. This gives the optimal movement pattern and its cost, under the assumption that each district has an equal probability of not being completed. (Note that these probabilities can be included in the costs if desired.) Then solve the transportation problems.

$$\min z = \sum_i \sum_j d_{ij}\, x_{ij} \quad \text{(or } d_{ij}\, p_i\, x_{ij}\text{, if completion probabilities vary)}$$

$$\text{s.t.} \quad \sum_i x_{ij} = 1 \qquad \forall_j$$

$$\sum_j x_{ij} = 1 \qquad \forall_i$$

$$X_{ij} = 0,1$$

where $d_{ij}$ = distance between district i and district j

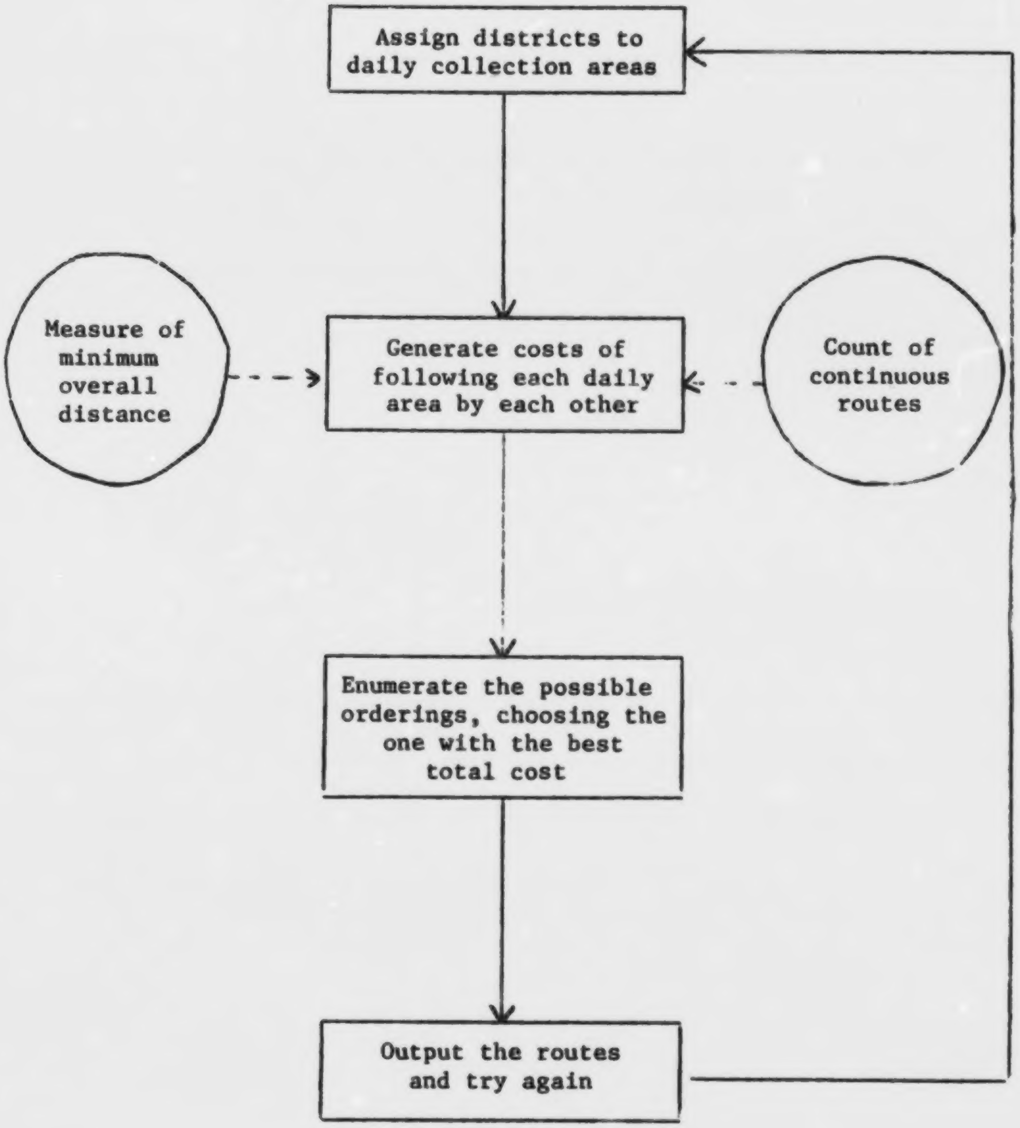
$x_{ij}$ = 1 if a truck collects district i and district j; 0 otherwise

$p_i$ = probability district i is not completed within the time alloted in the previous day

Given the $z_{k\ell}$ for each pairing of days k and ℓ, solve by simple enumeration

$$\min z = \sum_{\ell} \sum_{k} z_{k\ell}\, Y_{k\ell}$$

where $Y_{k\ell}$ = 1 if day k is followed by day ℓ. This orders the days to minimize total possible waste time. Note that a min-cost max-flow formulation is also possible, but significantly more complex to solve.


Assign districts to daily collection areas
Measure of minimum overall distance
Generate costs of following each daily area by each other
Count of continuous routes
Enumerate the possible orderings, choosing the one with the best total cost
Output the routes and try again

Aggegation Algorithm

(see the section on Linear Programming Districting Models for a description of MPSX and the presentation format)

ROWS: The objective functions DAY12 to DAY45 are the costs of moving trucks from daily areas to other daily areas. The five areas are tentatively labeled 1 to 5, so that the ten possible assignments are

1 → 2
1 → 3
1 → 4
1 → 5
2 → 3
2 → 4
2 → 5
3 → 4
3 → 5
4 → 5 (moves from, for example, 5 to 4 have the same cost as from 4 to 5)

The costs for each of these ten possible inter-day movements are the output of the program, along with information on which district in each day should be followed by which district in the next, to minimize this cost. These data are used in the second phase of the algorithm, as described above.

Rows SOURCE1 to SOURCE8 are transportation constraints stating that each district in the initial area contains only one truck which can be assigned. Rows SINK1 to SINK8 are also transportation constraints, this time forcing each district in the new day to receive at least one truck (and, therefore, only one).

The columns are simply shipment variables. DIST11 to DIST88 are one if the districts are joined in the assignment and 0 otherwise; thus, DIST34 would be equal to 1 if district 3 in the initial day was followed by district 4 in the next day on the same truck route. The costs differ depending on which of the possible day choices is being solved, so the solutions also differ.

```
         PROGRAM                                                        CNTL0001
         INITIALZ                                                       CNTL0002
         MOVE(XDATA,'AGGREGAT')                                         CNTL0003
         MOVE(XPRNAME,'AMFSWC')                                         CNTL0004
         CONVERT                                                        CNTL0005
         SETUP                                                          CNTL0006
         MOVE (XRHS,'TRANSP')                                           CNTL0007
         MACRO                                                          CNTL0008
         OPTIM(DUM1)                                                    CNTL0009
         MOVE (XOBJ,DUM1)                                               CNTL0010
         PRIMAL                                                         CNTL0011
         SOLUTION ('BASIS')                                             CNTL0012
DUM1     DC ('ABCDE')                                                   CNTL0013
         MEND                                                           CNTL0014
         OPTIM ('DAY12')                                                CNTL0015
         OPTIM ('DAY13')                                                CNTL0016
         OPTIM ('DAY14')                                                CNTL0017
         OPTIM ('DAY15')                                                CNTL0018
         OPTIM ('DAY23')                                                CNTL0019
         OPTIM ('DAY24')                                                CNTL0020
         OPTIM ('DAY25')                                                CNTL0021
         OPTIM ('DAY34')                                                CNTL0022
         OPTIM ('DAY35')                                                CNTL0023
         OPTIM ('DAY45')                                                CNTL0024
         EXIT                                                           CNTL0025
         PEND                                                           CNTL0026
NAME           AGGREGAT                                                 CNTL0027
```

```
ROWS                                                                    ROWS0001
 N  DAY12                                                               ROWS0002
 N  DAY13                                                               ROWS0003
 N  DAY14                                                               ROWS0004
 N  DAY15                                                               ROWS0005
 N  DAY23                                                               ROWS0006
 N  DAY24                                                               ROWS0007
 N  DAY25                                                               ROWS0008
 N  DAY34                                                               ROWS0009
 N  DAY35                                                               ROWS0010
 N  DAY45                                                               ROWS0011
 L  SOURCE1                                                             ROWS0012
 L  SOURCE2                                                             ROWS0013
 L  SOURCE3                                                             ROWS0014
 L  SOURCE4                                                             ROWS0015
 L  SOURCE5                                                             ROWS0016
 L  SOURCE6                                                             ROWS0017
 L  SOURCE7                                                             ROWS0018
 L  SOURCE8                                                             ROWS0019
 G  SINK1                                                               ROWS0020
 G  SINK2                                                               ROWS0021
 G  SINK3                                                               ROWS0022
 G  SINK4                                                               ROWS0023
 G  SINK5                                                               ROWS0024
 G  SINK6                                                               ROWS0025
 G  SINK7                                                               ROWS0026
 G  SINK8                                                               ROWS0027
```

```
COLUMNS                                                                           DIST0001
    DIST11    DAY12         7.1500    DAY13         56.6800                       DIST0002
    DIST11    DAY14        47.7299    DAY15        108.7899                       DIST0003
    DIST11    DAY23        42.9601    DAY24         61.7398                       DIST0004
    DIST11    DAY25       122.3298    DAY34         15.1501                       DIST0005
    DIST11    DAY35        56.9100    DAY45         50.4699                       DIST0006
    DIST11    SOURCE1       1.0       SINK1        1.0                            DIST0007
    DIST12    DAY12        24.1300    DAY13         75.5399                       DIST0008
    DIST12    DAY14        67.1500    DAY15        129.9499                       DIST0009
    DIST12    DAY23        62.6899    DAY24         89.2499                       DIST0010
    DIST12    DAY25       152.0498    DAY34         58.9602                       DIST0011
    DIST12    DAY35        86.6300    DAY45         73.8598                       DIST0012
    DIST12    SOURCE1       1.0       SINK2        1.0                            DIST0013
    DIST13    DAY12        47.5100    DAY13         69.7401                       DIST0014
    DIST13    DAY14        62.9600    DAY15        161.2899                       DIST0015
    DIST13    DAY23        64.1000    DAY24         76.7299                       DIST0016
    DIST13    DAY25       178.5098    DAY34         20.7499                       DIST0017
    DIST13    DAY35       113.0900    DAY45        106.1699                       DIST0018
    DIST13    SOURCE1       1.0       SINK3        1.0                            DIST0019
    DIST14    DAY12        26.4501    DAY13         96.7399                       DIST0020
    DIST14    DAY14        67.5401    DAY15        229.1699                       DIST0021
    DIST14    DAY23        80.5499    DAY24         89.6400                       DIST0022
    DIST14    DAY25       251.2698    DAY34         52.0299                       DIST0023
    DIST14    DAY35       185.8500    DAY45        170.3798                       DIST0024
    DIST14    SOURCE1       1.0       SINK4        1.0                            DIST0025
    DIST15    DAY12        41.9099    DAY13         83.8699                       DIST0026
    DIST15    DAY14        58.5900    DAY15        139.1799                       DIST0027
    DIST15    DAY23        84.5098    DAY24         80.6899                       DIST0028
    DIST15    DAY25       161.2798    DAY34         33.3399                       DIST0029
    DIST15    DAY35        95.8600    DAY45         80.3898                       DIST0030
    DIST15    SOURCE1       1.0       SINK5        1.0                            DIST0031
    DIST16    DAY12        31.9299    DAY13         88.9499                       DIST0032
    DIST16    DAY14       103.4900    DAY15        248.7399                       DIST0033
    DIST16    DAY23        94.8798    DAY24        125.5899                       DIST0034
    DIST16    DAY25       270.8396    DAY34         78.5598                       DIST0035
    DIST16    DAY35       205.4200    DAY45        189.9498                       DIST0036
```

```
DIST16    SOURCE1       1.0      SINK6       1.0                      DIST0037
DIST17    DAY12        67.6701   DAY13     120.9499                   DIST0038
DIST17    DAY14        81.9901   DAY15     296.6697                   DIST0039
DIST17    DAY23       108.7199   DAY24     104.0900                   DIST0040
DIST17    DAY25       318.7698   DAY34      48.9298                   DIST0041
DIST17    DAY35       253.3500   DAY45     237.8798                   DIST0042
DIST17    SOURCE1       1.0      SINK7       1.0                      DIST0043
DIST18    DAY12        52.8699   DAY13     102.5099                   DIST0044
DIST18    DAY14       111.0500   DAY15     330.8098                   DIST0045
DIST18    DAY23       124.6098   DAY24     133.1499                   DIST0046
DIST18    DAY25       352.9097   DAY34      72.6700                   DIST0047
DIST18    DAY35       287.4900   DAY45     272.0198                   DIST0048
DIST18    SOURCE1       1.0      SINK8       1.0                      DIST0049
DIST21    DAY12         6.5798   DAY13      37.7900                   DIST0050
DIST21    DAY14        39.7195   DAY15      97.7099                   DIST0051
DIST21    DAY23        28.6902   DAY24      48.8200                   DIST0052
DIST21    DAY25       109.4100   DAY34      24.9899                   DIST0053
DIST21    DAY35        29.1500   DAY45     100.5900                   DIST0054
DIST21    SOURCE2       1.0      SINK1       1.0                      DIST0055
DIST22    DAY12        11.5501   DAY13      54.4899                   DIST0056
DIST22    DAY14        64.6300   DAY15     127.4299                   DIST0057
DIST22    DAY23        47.5800   DAY24      77.8899                   DIST0058
DIST22    DAY25       139.1300   DAY34      80.4000                   DIST0059
DIST22    DAY35        58.8700   DAY45      93.0700                   DIST0060
DIST22    SOURCE2       1.0      SINK2       1.0                      DIST0061
DIST23    DAY12        34.2899   DAY13      49.5701                   DIST0062
DIST23    DAY14        52.1100   DAY15     153.8899                   DIST0063
DIST23    DAY23        51.1801   DAY24      63.8101                   DIST0064
DIST23    DAY25       165.5900   DAY34      16.4600                   DIST0065
DIST23    DAY35        85.3300   DAY45     108.7900                   DIST0066
DIST23    SOURCE2       1.0      SINK3       1.0                      DIST0067
DIST24    DAY12         5.5000   DAY13      81.5299                   DIST0068
DIST24    DAY14        65.0201   DAY15     226.6499                   DIST0069
DIST24    DAY23        61.0800   DAY24      76.7202                   DIST0070
DIST24    DAY25       238.3500   DAY34      60.3699                   DIST0071
DIST24    DAY35       158.0900   DAY45     165.1698                   DIST0072
```

```
    DIST24    SOURCE2         1.0      SINK4        1.0                           DIST0073
    DIST25    DAY12          22.9599   DAY13       66.4398                        DIST0074
    DIST25    DAY14          56.0700   DAY15      136.6599                        DIST0075
    DIST25    DAY23          71.5900   DAY24       67.7701                        DIST0076
    DIST25    DAY25         148.3600   DAY34       38.8400                        DIST0077
    DIST25    DAY35          68.1000   DAY45       47.1898                        DIST0078
    DIST25    SOURCE2         1.0      SINK5        1.0                           DIST0079
    DIST26    DAY12          12.5999   DAY13       76.6898                        DIST0080
    DIST26    DAY14         100.9700   DAY15      246.2199                        DIST0081
    DIST26    DAY23          81.9600   DAY24      112.6701                        DIST0082
    DIST26    DAY25         257.9199   DAY34       82.2399                        DIST0083
    DIST26    DAY35         177.6600   DAY45      144.6098                        DIST0084
    DIST26    SOURCE2         1.0      SINK6        1.0                           DIST0085
    DIST27    DAY12          54.4500   DAY13      102.8099                        DIST0086
    DIST27    DAY14          79.4701   DAY15      294.1499                        DIST0087
    DIST27    DAY23          95.1300   DAY24       91.1702                        DIST0088
    DIST27    DAY25         305.8499   DAY34       51.0300                        DIST0089
    DIST27    DAY35         225.5900   DAY45      192.5398                        DIST0090
    DIST27    SOURCE2         1.0      SINK7        1.0                           DIST0091
    DIST28    DAY12          34.8000   DAY13       99.9899                        DIST0092
    DIST28    DAY14         108.5300   DAY15      328.2898                        DIST0093
    DIST28    DAY23         111.6900   DAY24      120.2301                        DIST0094
    DIST28    DAY25         339.9897   DAY34       60.0000                        DIST0095
    DIST28    DAY35         259.7300   DAY45      226.6798                        DIST0096
    DIST28    SOURCE2         1.0      SINK8        1.0                           DIST0097
    DIST31    DAY12          32.9101   DAY13       54.6201                        DIST0098
    DIST31    DAY14          33.6200   DAY15       97.0400                        DIST0099
    DIST31    DAY23           3.6898   DAY24       28.7601                        DIST0100
    DIST31    DAY25          82.2499   DAY34        8.8601                        DIST0101
    DIST31    DAY35          36.4600   DAY45       31.1100                        DIST0102
    DIST31    SOURCE3         1.0      SINK1        1.0                           DIST0103
    DIST32    DAY12          38.2000   DAY13       76.0600                        DIST0104
    DIST32    DAY14          38.1701   DAY15      114.5699                        DIST0105
    DIST32    DAY23          20.4200   DAY24       70.8499                        DIST0106
    DIST32    DAY25         111.9700   DAY34       64.2702                        DIST0107
    DIST32    DAY35          65.5000   DAY45       49.6800                        DIST0108
```

```
DIST32    SOURCE3       1.0     SINK2       1.0                  DIST0109
DIST33    DAY12        58.6400  DAY13      59.9302               DIST0110
DIST33    DAY14        48.8501  DAY15     148.8500               DIST0111
DIST33    DAY23        24.0201  DAY24      36.6501               DIST0112
DIST33    DAY25       138.4300  DAY34       4.2000               DIST0113
DIST33    DAY35        91.9600  DAY45      84.0400               DIST0114
DIST33    SOURCE3       1.0     SINK3       1.0                  DIST0115
DIST34    DAY12        18.4001  DAY13      94.1700               DIST0116
DIST34    DAY14        38.5601  DAY15     200.1900               DIST0117
DIST34    DAY23        35.7000  DAY24      59.3000               DIST0118
DIST34    DAY25       211.1900  DAY34      44.2401               DIST0119
DIST34    DAY35       164.7200  DAY45     140.5100               DIST0120
DIST34    SOURCE3       1.0     SINK4       1.0                  DIST0121
DIST35    DAY12        44.6900  DAY13      71.4800               DIST0122
DIST35    DAY14        43.1001  DAY15     110.2000               DIST0123
DIST35    DAY23        44.4299  DAY24      40.6100               DIST0124
DIST35    DAY25       121.2000  DAY34      23.3600               DIST0125
DIST35    DAY35        74.7300  DAY45      49.3400               DIST0126
DIST35    SOURCE3       1.0     SINK5       1.0                  DIST0127
DIST36    DAY12        22.1200  DAY13      59.9700               DIST0128
DIST36    DAY14        74.5101  DAY15     219.7599               DIST0129
DIST36    DAY23        54.7999  DAY24      93.0701               DIST0130
DIST36    DAY25       230.7599  DAY34      66.7598               DIST0131
DIST36    DAY35       184.2900  DAY45     158.9000               DIST0132
DIST36    SOURCE3       1.0     SINK6       1.0                  DIST0133
DIST37    DAY12        78.8001  DAY13     111.1400               DIST0134
DIST37    DAY14        53.0101  DAY15     267.6899               DIST0135
DIST37    DAY23        67.9700  DAY24      64.0101               DIST0136
DIST37    DAY25       278.6899  DAY34      37.1198               DIST0137
DIST37    DAY35       232.2200  DAY45     206.8300               DIST0138
DIST37    SOURCE3       1.0     SINK7       1.0                  DIST0139
DIST38    DAY12        43.0600  DAY13      80.7100               DIST0140
DIST38    DAY14        82.0701  DAY15     301.8298               DIST0141
DIST38    DAY23        84.5300  DAY24      93.0701               DIST0142
DIST38    DAY25       312.8298  DAY34      53.2600               DIST0143
DIST38    DAY35       266.3599  DAY45     240.9700               DIST0144
```

```
DIST38    SOURCE3      1.0      SINK8     1.0                   DIST0145
DIST41    DAY12       27.4300   DAY13      38.5901              DIST0146
DIST41    DAY14       22.8798   DAY15      81.2198              DIST0147
DIST41    DAY23       27.0902   DAY24      37.8099              DIST0148
DIST41    DAY25       98.3999   DAY34      43.0999              DIST0149
DIST41    DAY35        8.1800   DAY45      80.5599              DIST0150
DIST41    SOURCE4      1.0      SINK1     1.0                   DIST0151
DIST42    DAY12       30.5598   DAY13      60.0300              DIST0152
DIST42    DAY14       42.2999   DAY15     105.0998              DIST0153
DIST42    DAY23       45.9800   DAY24      65.3200              DIST0154
DIST42    DAY25      128.1199   DAY34      98.5100              DIST0155
DIST42    DAY35       37.9000   DAY45      73.0999              DIST0156
DIST42    SOURCE4      1.0      SINK2     1.0                   DIST0157
DIST43    DAY12       42.6100   DAY13      43.9001              DIST0158
DIST43    DAY14       35.8199   DAY15     137.2798              DIST0159
DIST43    DAY23       41.5301   DAY24      52.8000              DIST0160
DIST43    DAY25      154.5799   DAY34      28.6700              DIST0161
DIST43    DAY35       64.3600   DAY45      94.0098              DIST0162
DIST43    SOURCE4      1.0      SINK3     1.0                   DIST0163
DIST44    DAY12        9.2901   DAY13      78.1400              DIST0164
DIST44    DAY14       42.6900   DAY15     204.3198              DIST0165
DIST44    DAY23       64.1399   DAY24      65.7101              DIST0166
DIST44    DAY25      227.3399   DAY34      78.4799              DIST0167
DIST44    DAY35      137.1200   DAY45     154.9498              DIST0168
DIST44    SOURCE4      1.0      SINK4     1.0                   DIST0169
DIST45    DAY12       28.6600   DAY13      56.7398              DIST0170
DIST45    DAY14       33.7399   DAY15     114.3298              DIST0171
DIST45    DAY23       60.5799   DAY24      56.7600              DIST0172
DIST45    DAY25      137.3499   DAY34      56.9500              DIST0173
DIST45    DAY35       55.9300   DAY45      39.1399              DIST0174
DIST45    SOURCE4      1.0      SINK5     1.0                   DIST0175
DIST46    DAY12        6.0900   DAY13      64.0998              DIST0176
DIST46    DAY14       78.6399   DAY15     223.8898              DIST0177
DIST46    DAY23       70.9499   DAY24     101.6600              DIST0178
DIST46    DAY25      246.9099   DAY34     100.3498              DIST0179
DIST46    DAY35      156.6900   DAY45     144.3199              DIST0180
```

```
DIST46    SOURCE4      1.0       SINK6       1.0                        DIST0181
DIST47    DAY12       62.7701    DAY13      95.1100                     DIST0182
DIST47    DAY14       57.1400    DAY15     271.8196                     DIST0183
DIST47    DAY23       93.5300    DAY24      80.1601                     DIST0184
DIST47    DAY25      294.8398    DAY34      59.1800                     DIST0185
DIST47    DAY35      204.6200    DAY45     192.2499                     DIST0186
DIST47    SOURCE4      1.0       SINK7       1.0                        DIST0187
DIST48    DAY12       27.0300    DAY13      77.6598                     DIST0188
DIST48    DAY14       86.1999    DAY15     305.9597                     DIST0189
DIST48    DAY23      100.6799    DAY24     109.2201                     DIST0190
DIST48    DAY25      328.9797    DAY34      54.6700                     DIST0191
DIST48    DAY35      238.7600    DAY45     226.3899                     DIST0192
DIST48    SOURCE4      1.0       SINK8       1.0                        DIST0193
DIST51    DAY12       50.5099    DAY13      45.7801                     DIST0194
DIST51    DAY14       15.4200    DAY15      87.4100                     DIST0195
DIST51    DAY23        6.8401    DAY24      21.2399                     DIST0196
DIST51    DAY25       81.8299    DAY34      24.8899                     DIST0197
DIST51    DAY35       23.0000    DAY45      59.0300                     DIST0198
DIST51    SOURCE5      1.0       SINK1       1.0                        DIST0199
DIST52    DAY12       43.9700    DAY13      67.2200                     DIST0200
DIST52    DAY14       21.3100    DAY15      97.7099                     DIST0201
DIST52    DAY23       25.4499    DAY24      60.4899                     DIST0202
DIST52    DAY25      111.5499    DAY34      75.3000                     DIST0203
DIST52    DAY35       44.3600    DAY45      61.5400                     DIST0204
DIST52    SOURCE5      1.0       SINK2       1.0                        DIST0205
DIST53    DAY12       49.8000    DAY13      51.0901                     DIST0206
DIST53    DAY14       32.5101    DAY15     125.4799                     DIST0207
DIST53    DAY23       23.6001    DAY24      36.2300                     DIST0208
DIST53    DAY25      138.0099    DAY34       5.4600                     DIST0209
DIST53    DAY35       76.4200    DAY45      93.4500                     DIST0210
DIST53    SOURCE5      1.0       SINK3       1.0                        DIST0211
DIST54    DAY12       26.5800    DAY13      85.3300                     DIST0212
DIST54    DAY14       10.9001    DAY15     181.8699                     DIST0213
DIST54    DAY23       46.4799    DAY24      57.1202                     DIST0214
DIST54    DAY25      210.7699    DAY34      55.2699                     DIST0215
DIST54    DAY35      143.5800    DAY45     145.7000                     DIST0216
```

```
DIST54    SOURCE5          1.0     SINK4          1.0               DIST0217
DIST55    DAY12           35.8500  DAY13         62.1200            DIST0218
DIST55    DAY14           25.5001  DAY15         82.5399            DIST0219
DIST55    DAY23           44.0099  DAY24         40.1900            DIST0220
DIST55    DAY25          120.7799  DAY34         33.7400            DIST0221
DIST55    DAY35           53.5900  DAY45         50.5100            DIST0222
DIST55    SOURCE5          1.0     SINK5          1.0               DIST0223
DIST56    DAY12           13.9501  DAY13         32.3099            DIST0224
DIST56    DAY14           46.8501  DAY15        192.0999            DIST0225
DIST56    DAY23           54.3799  DAY24         85.1400            DIST0226
DIST56    DAY25          230.3399  DAY34         77.1398            DIST0227
DIST56    DAY35          163.1500  DAY45        160.0700            DIST0228
DIST56    SOURCE5          1.0     SINK6          1.0               DIST0229
DIST57    DAY12           69.9601  DAY13        102.3000            DIST0230
DIST57    DAY14           25.3501  DAY15        240.0299            DIST0231
DIST57    DAY23           71.8699  DAY24         63.5901            DIST0232
DIST57    DAY25          278.2698  DAY34         35.9700            DIST0233
DIST57    DAY35          211.0800  DAY45        208.0000            DIST0234
DIST57    SOURCE5          1.0     SINK7          1.0               DIST0235
DIST58    DAY12           34.2200  DAY13         53.0499            DIST0236
DIST58    DAY14           54.4101  DAY15        274.1699            DIST0237
DIST58    DAY23           84.1099  DAY24         92.6500            DIST0238
DIST58    DAY25          312.4097  DAY34         37.0400            DIST0239
DIST58    DAY35          245.2200  DAY45        242.1400            DIST0240
DIST58    SOURCE5          1.0     SINK8          1.0               DIST0241
DIST61    DAY12           47.4199  DAY13         29.7201            DIST0242
DIST61    DAY14            6.5302  DAY15         71.6500            DIST0243
DIST61    DAY23           13.6101  DAY24          6.9599            DIST0244
DIST61    DAY25           64.5299  DAY34         30.1598            DIST0245
DIST61    DAY35           11.1100  DAY45        102.4299            DIST0246
DIST61    SOURCE6          1.0     SINK1          1.0               DIST0247
DIST62    DAY12           34.9600  DAY13         51.1600            DIST0248
DIST62    DAY14           25.5102  DAY15         88.0098            DIST0249
DIST62    DAY23           35.0500  DAY24         39.0699            DIST0250
DIST62    DAY25           90.1299  DAY34         27.9800            DIST0251
DIST62    DAY35           34.3300  DAY45         94.9099            DIST0252
```

```
DIST62     SOURCE6        1.0       SINK2          1.0                            DIST0253
DIST63     DAY12         39.9101    DAY13         35.0302                         DIST0254
DIST63     DAY14         18.1300    DAY15        113.1198                         DIST0255
DIST63     DAY23         20.8601    DAY24         19.1300                         DIST0256
DIST63     DAY25        117.0299    DAY34          7.4100                         DIST0257
DIST63     DAY35         63.6100    DAY45        105.5999                         DIST0258
DIST63     SOURCE6        1.0       SINK3          1.0                            DIST0259
DIST64     DAY12         23.4900    DAY13         69.2700                         DIST0260
DIST64     DAY14         21.4100    DAY15        174.9098                         DIST0261
DIST64     DAY23         56.4600    DAY24         35.8501                         DIST0262
DIST64     DAY25        189.3499    DAY34          7.9499                         DIST0263
DIST64     DAY35        133.5500    DAY45        148.4700                         DIST0264
DIST64     SOURCE6        1.0       SINK4          1.0                            DIST0265
DIST65     DAY12         26.8400    DAY13         46.0600                         DIST0266
DIST65     DAY14         10.4499    DAY15         84.9198                         DIST0267
DIST65     DAY23         40.0499    DAY24         18.7699                         DIST0268
DIST65     DAY25         99.3599    DAY34          6.3100                         DIST0269
DIST65     DAY35         38.8900    DAY45         32.5099                         DIST0270
DIST65     SOURCE6        1.0       SINK5          1.0                            DIST0271
DIST66     DAY12          6.2599    DAY13         34.6898                         DIST0272
DIST66     DAY14         51.0201    DAY15        194.4798                         DIST0273
DIST66     DAY23         49.1299    DAY24         63.7199                         DIST0274
DIST66     DAY25        208.9199    DAY34         29.8198                         DIST0275
DIST66     DAY35        148.4500    DAY45        122.7598                         DIST0276
DIST66     SOURCE6        1.0       SINK6          1.0                            DIST0277
DIST67     DAY12         53.9001    DAY13         86.2400                         DIST0278
DIST67     DAY14         27.7300    DAY15        242.4098                         DIST0279
DIST67     DAY23         76.3100    DAY24         42.1701                         DIST0280
DIST67     DAY25        256.8499    DAY34          2.8799                         DIST0281
DIST67     DAY35        196.3800    DAY45        170.6898                         DIST0282
DIST67     SOURCE6        1.0       SINK7          1.0                            DIST0283
DIST68     DAY12         18.1600    DAY13         48.2498                         DIST0284
DIST68     DAY14         56.7900    DAY15        276.5498                         DIST0285
DIST68     DAY23         62.6899    DAY24         71.2300                         DIST0286
DIST68     DAY25        290.9897    DAY34         17.4200                         DIST0287
DIST68     DAY35        230.5200    DAY45        204.8298                         DIST0288
```

```
DIST68    SOURCE6         1.0      SINK8       1.0                          DIST0289
DIST71    DAY12          61.7200   DAY13        62.2800                     DIST0290
DIST71    DAY14          31.5399   DAY15       103.9099                     DIST0291
DIST71    DAY23           9.6500   DAY24        28.0099                     DIST0292
DIST71    DAY25          72.9300   DAY34        60.0899                     DIST0293
DIST71    DAY35           3.9700   DAY45        61.2600                     DIST0294
DIST71    SOURCE7         1.0      SINK1       1.0                          DIST0295
DIST72    DAY12          60.4699   DAY13        83.7199                     DIST0296
DIST72    DAY14           4.8401   DAY15       104.5900                     DIST0297
DIST72    DAY23          11.1000   DAY24        83.1402                     DIST0298
DIST72    DAY25         102.6500   DAY34       115.4800                     DIST0299
DIST72    DAY35          14.3300   DAY45        53.7400                     DIST0300
DIST72    SOURCE7         1.0      SINK2       1.0                          DIST0301
DIST73    DAY12          66.2999   DAY13        67.5901                     DIST0302
DIST73    DAY14          41.2201   DAY15       125.1399                     DIST0303
DIST73    DAY23          20.3901   DAY24        33.0200                     DIST0304
DIST73    DAY25         129.1100   DAY34        45.6400                     DIST0305
DIST73    DAY35          33.3100   DAY45        76.2200                     DIST0306
DIST73    SOURCE7         1.0      SINK3       1.0                          DIST0307
DIST74    DAY12          45.2700   DAY13       101.8299                     DIST0308
DIST74    DAY14           6.7601   DAY15       186.0799                     DIST0309
DIST74    DAY23          24.6000   DAY24        63.3899                     DIST0310
DIST74    DAY25         201.8700   DAY34        95.4499                     DIST0311
DIST74    DAY35         106.0700   DAY45       139.7400                     DIST0312
DIST74    SOURCE7         1.0      SINK4       1.0                          DIST0313
DIST75    DAY12          52.3499   DAY13        78.6199                     DIST0314
DIST75    DAY14          34.2101   DAY15        76.0099                     DIST0315
DIST75    DAY23          35.1100   DAY24        47.1801                     DIST0316
DIST75    DAY25         111.8800   DAY34        73.9200                     DIST0317
DIST75    DAY35          49.3200   DAY45        23.6800                     DIST0318
DIST75    SOURCE7         1.0      SINK5       1.0                          DIST0319
DIST76    DAY12          31.0100   DAY13        38.9799                     DIST0320
DIST76    DAY14          40.3200   DAY15       185.5699                     DIST0321
DIST76    DAY23          45.4800   DAY24        89.4401                     DIST0322
DIST76    DAY25         221.4400   DAY34       117.3199                     DIST0323
DIST76    DAY35         125.6400   DAY45       129.9600                     DIST0324
```

```
 DIST76    SOURCE7        1.0    SINK6         1.0                    DIST0325
 DIST77    DAY12         86.4600 DAY13       118.7999                 DIST0326
 DIST77    DAY14         32.0201 DAY15       233.4999                 DIST0327
 DIST77    DAY23         58.6500 DAY24        60.3801                 DIST0328
 DIST77    DAY25        269.3699 DAY34        76.1500                 DIST0329
 DIST77    DAY35        173.5700 DAY45       177.8900                 DIST0330
 DIST77    SOURCE7        1.0    SINK7         1.0                    DIST0331
 DIST78    DAY12         50.7199 DAY13        59.7199                 DIST0332
 DIST78    DAY14         47.8800 DAY15       267.6396                 DIST0333
 DIST78    DAY23         75.2100 DAY24        89.4401                 DIST0334
 DIST78    DAY25        303.5098 DAY34        67.9400                 DIST0335
 DIST78    DAY35        207.7100 DAY45       212.0300                 DIST0336
 DIST78    SOURCE7        1.0    SINK8         1.0                    DIST0337
 DIST81    DAY12         68.8200 DAY13        38.6501                 DIST0338
 DIST81    DAY14         13.5501 DAY15        80.2799                 DIST0339
 DIST81    DAY23          6.1499 DAY24         3.5900                 DIST0340
 DIST81    DAY25         62.2398 DAY34        43.7198                 DIST0341
 DIST81    DAY35          5.7000 DAY45        53.0500                 DIST0342
 DIST81    SOURCE8        1.0    SINK1         1.0                    DIST0343
 DIST82    DAY12         55.9001 DAY13        60.0899                 DIST0344
 DIST82    DAY14         10.6000 DAY15        82.7899                 DIST0345
 DIST82    DAY23         22.1198 DAY24        47.4000                 DIST0346
 DIST82    DAY25         91.9598 DAY34        45.1200                 DIST0347
 DIST82    DAY35          5.9600 DAY45        45.5300                 DIST0348
 DIST82    SOURCE8        1.0    SINK2         1.0                    DIST0349
 DIST83    DAY12         51.9499 DAY13        43.9601                 DIST0350
 DIST83    DAY14         17.5901 DAY15       113.8300                 DIST0351
 DIST83    DAY23          5.9900 DAY24        16.6399                 DIST0352
 DIST83    DAY25        118.4198 DAY34        19.8500                 DIST0353
 DIST83    DAY35         30.8400 DAY45        61.2500                 DIST0354
 DIST83    SOURCE8        1.0    SINK3         1.0                    DIST0355
 DIST84    DAY12         44.8901 DAY13        78.1999                 DIST0356
 DIST84    DAY14          5.5502 DAY15       167.8899                 DIST0357
 DIST84    DAY23         40.2298 DAY24        40.0101                 DIST0358
 DIST84    DAY25        191.1798 DAY34        28.4499                 DIST0359
 DIST84    DAY35         94.3600 DAY45       122.1900                 DIST0360
```

```
DIST84    SOURCE8       1.0     SINK4       1.0                  DIST0361
DIST85    DAY12        37.9999  DAY13      54.9899               DIST0362
DIST85    DAY14        13.1801  DAY15      70.8900               DIST0363
DIST85    DAY23        24.4198  DAY24      22.0601               DIST0364
DIST85    DAY25       101.1898  DAY34      21.0200               DIST0365
DIST85    DAY35         9.9100  DAY45       6.9100               DIST0366
DIST85    SOURCE8       1.0     SINK5       1.0                  DIST0367
DIST86    DAY12        21.4600  DAY13      22.2598               DIST0368
DIST86    DAY14        35.2001  DAY15     180.4500               DIST0369
DIST86    DAY23        34.7898  DAY24      72.9099               DIST0370
DIST86    DAY25       210.7498  DAY34      46.9599               DIST0371
DIST86    DAY35        87.5300  DAY45     111.5300               DIST0372
DIST86    SOURCE8       1.0     SINK6       1.0                  DIST0373
DIST87    DAY12        62.8301  DAY13      95.1699               DIST0374
DIST87    DAY14        16.6199  DAY15     228.3800               DIST0375
DIST87    DAY23        63.3798  DAY24      44.0000               DIST0376
DIST87    DAY25       258.6797  DAY34       9.1500               DIST0377
DIST87    DAY35       135.4600  DAY45     159.4600               DIST0378
DIST87    SOURCE8       1.0     SINK7       1.0                  DIST0379
DIST88    DAY12        27.0899  DAY13      42.9998               DIST0380
DIST88    DAY14        42.7601  DAY15     262.5198               DIST0381
DIST88    DAY23        64.5198  DAY24      73.0600               DIST0382
DIST88    DAY25       292.8198  DAY34       6.8600               DIST0383
DIST88    DAY35       169.6000  DAY45     193.6000               DIST0384
DIST88    SOURCE8       1.0     SINK8       1.0                  DIST0385
```

```
RHS                                                                                RHS 0001
    TRANSP    SOURCE1      1.0         SINK1        1.0                            RHS 0002
    TRANSP    SOURCE2      1.0         SINK2        1.0                            RHS 0003
    TRANSP    SOURCE3      1.0         SINK3        1.0                            RHS 0004
    TRANSP    SOURCE4      1.0         SINK4        1.0                            RHS 0005
    TRANSP    SOURCE5      1.0         SINK5        1.0                            RHS 0006
    TRANSP    SOURCE6      1.0         SINK6        1.0                            RHS 0007
    TRANSP    SOURCE7      1.0         SINK7        1.0                            RHS 0008
    TRANSP    SOURCE8      1.0         SINK8        1.0                            RHS 0009
ENDATA                                                                             RHS 0010
```

## VI. The Chinese Postman Problem

The Chinese Postman Problem can be described as that of finding the minimum-distance covering of a graph.

$$\text{Min} \sum_i \sum_j C_{ij}\, x_{ij}$$

s.t.

$$\sum_k x_{ki} - \sum_k x_{ik} = 0 \qquad \forall\ i$$

$$x_{ij} + x_{ji} \geq 1 \qquad \forall\ i,j$$

$$x_{ij} \geq 0 \text{ (and integer)}$$

where $C_{ij}$ is the cost of travelling arc ij and

$x_{ij}$ is the number of times arc ij is travelled from i to j

Euler showed in 1736 that on an undirected graph with zero or two nodes of odd degree (nodes with an odd number of incident arcs) there exists a tour which covers each arc only once (an Euler Tour). Mei-Ko showed that the problem in graphs with odd nodes reduces to minimally pairing the odd nodes; that is, adding arcs between pairs of odd nodes such that the total added distance is minimized. He also proved that a feasible solution is optimal if and only if

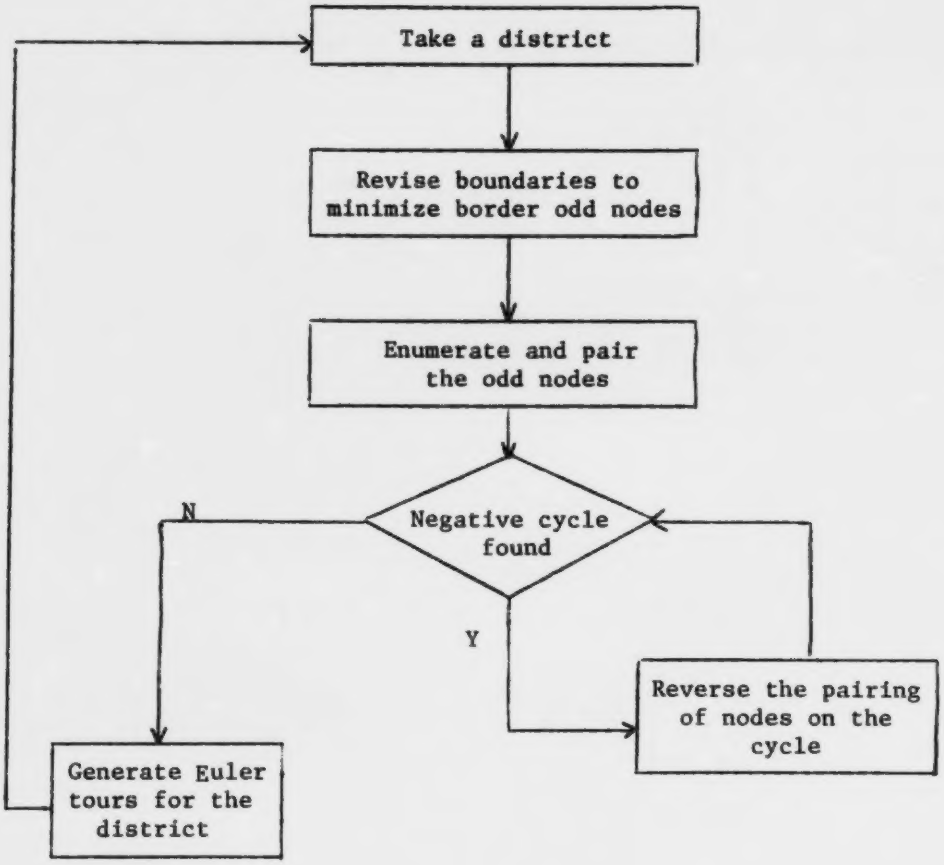
a. no arc is duplicated more than once;

b. the length of added arcs on every cycle does not exceed half the length of the cycle. A cycle is a continuous path which starts and ends at the same node.

This theorem, although not usable computationally, is the basis for the Stricker algorithm. The negative cycle - the cycle which is more than half added arcs - can be visually recognized fairly easily, so the optimal pairing can be generated quickly by hand. There is no optimality proof since every cycle is not enumerated and checked, but results very close to optimal are expected.

Computational algorithms have been developed which lead to optimality, for example by Edmonds, but the Stricker methodology is an efficient low-cost heuristic. Extensions have also been made to directed and bidirected networks.

An optimal pairing gives an augmented network with all even nodes. There still remains the problem of drawing the Euler tour. By computer, this is a cumbersome process. By hand, it simply involves care not to divide the network into two disjoint regions at any time in the drawing of the route. Since there are many alternate tours, the manual algorithm also allows control over secondary objectives such as going the correct direction on one-way streets and minimizing U-turns.


Take a district
Revise boundaries to minimize border odd nodes
Enumerate and pair the odd nodes
Negative cycle found
N
Y
Reverse the pairing of nodes on the cycle
Generate Euler tours for the district

Chinese Postman Algorithm

## VII. The Truck Dispatching Program and the Clarke and Wright Algorithm

The N-vehicle Truck Dispatching Problem can be formulated as

$$\text{minimize} \quad z = \sum_{i}^{M} \sum_{j}^{M} \sum_{k}^{N} t_{ij} \, \ell_{ij} \, k \qquad (1)$$

subject to

$$\sum_{i=1}^{M} \sum_{k=1}^{N} \ell_{ijk} = 1 \qquad j = 2, \dots, M \qquad (2a)$$

$$\sum_{j=1}^{M} \sum_{k=1}^{N} \ell_{ijk} = 1 \qquad i = 2, \dots, M \qquad (2b)$$

$$\sum_{i=1}^{M} \ell_{ipk} - \sum_{j=1}^{M} \ell_{pjk} = 0 \qquad \begin{matrix} k = 1, \dots, N \\ p = 2, \dots, M \end{matrix} \qquad (3)$$

$$P_k - \sum_{i=1}^{M} \left( Q_i \sum_{j=1}^{M} \ell_{ijk} \right) \geq 0 \qquad \forall_k = 1, \dots, N \qquad (4)$$

$$T_k - \sum_{i=1}^{M} \left( t_i \sum_{j=1}^{M} \ell_{ijk} \right) + \sum_{i=1}^{M} \sum_{j=1}^{M} t_{ijk} \geq 0 \qquad \forall_k \qquad (5)$$

$$\sum_{j=2}^{M} \ell_{1jk} = 1 \qquad \forall_k \qquad (6a)$$

$$\sum_{i=2}^{M} \ell_{i1k} = 1 \qquad \forall_k \qquad (6b)$$

where

M = number of nodes (node 1 is the central depot, nodes 2 to N demands)

N = number of vehicles

$P_k$ = capacity of vehicle k

$T_k$ = maximum time allowed for route of vehicle k

$Q_i$ = demand at node i ($Q_1 = 0$)

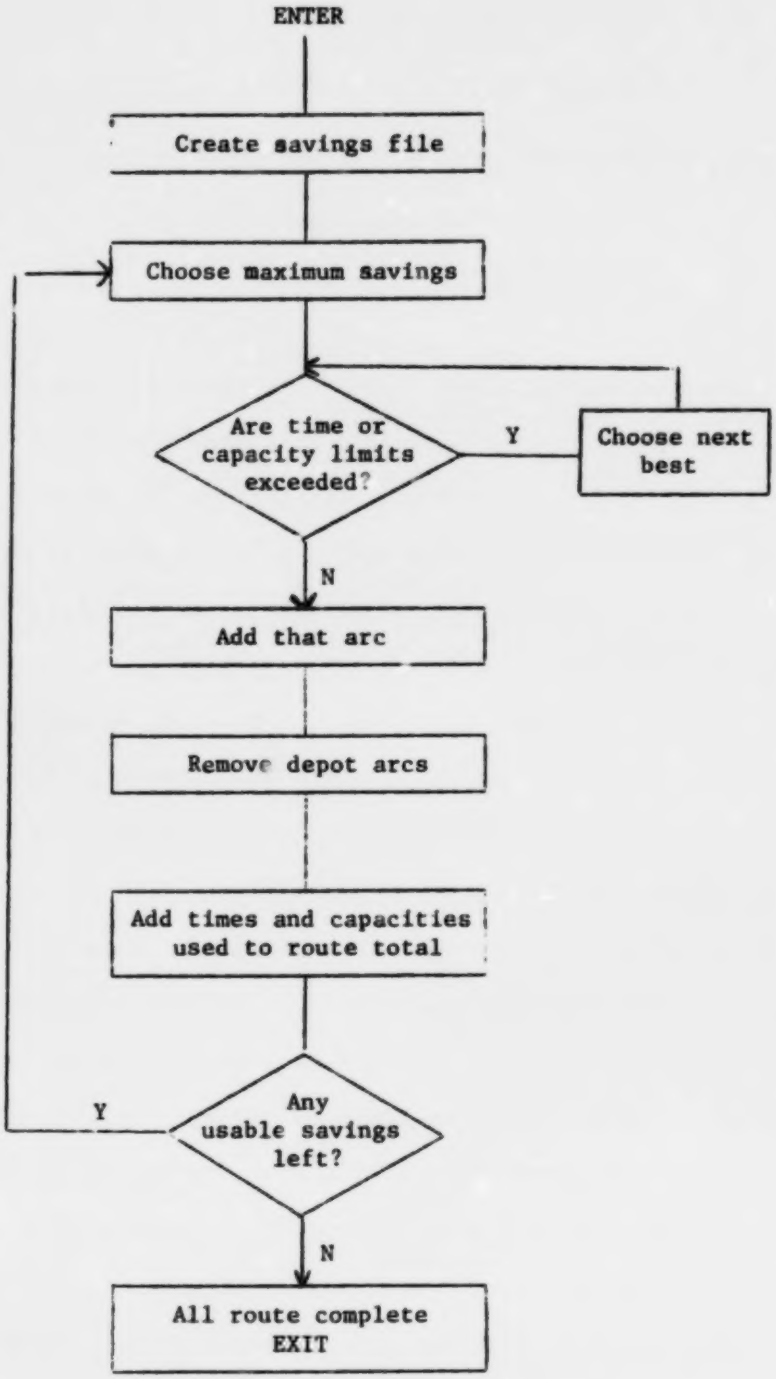
$t_i$ = time required to collect node i ($t_1 = 0$)

$t_{ij}$ = travel time from node i to node j.

$\ell_{ijk}$ = 1 if path ij is travelled by truck k,
0 otherwise

Equation (1) is total travel time, which is to be minimized. Equations (2a) and (2b) state that each node must be served by some truck - and allow only one truck per demand. Equation (3) is simply route continuity: if a truck enters a demand node, it must leave it. Equations (4) and (5) are truck constraints: the first limits capacity, the second total elapsed route time. Equations (6a) and (6b) simply state that all trucks must be used, an easy requirement to relax. Note that this formulation does not allow for varying collection frequencies at the different demand nodes, a situation often encountered in solide waste collection.

In the Clarke and Wright approach, a transformation is made into the dual objective function, where instead of minimizing time, a "time savings" over an initial solution is maximized. The constraint on fleet size is relaxed, so that this initial feasible solution is simply to serve each demand with its own truck. Routes are then combined by a simple procedure, as described in the text. Pierce gives a branch-and-bound methodology for successively improving feasible solutions in a manner which will terminate at optimality.


ENTER
Create savings file
Choose maximum savings
Are time or capacity limits exceeded?
Y
Choose next best
N
Add that arc
Remove depot arcs
Add times and capacities used to route total
Y
Any usable savings left?
N
All route complete EXIT

Clarke and Wright Algorithm

```
// 'JIM HUDSON',CLASS=C,REGION=320K
/*MITID USER=(M9169,9932)
/*SRI LOW
/*MAIN  TIME=2,LINES=2
//        EXEC FORCLG
//C.SYSIN DD *
C    CLARKE AND WRIGHT TRUCK DISPATCHING HEURISTIC.
C    USED FOR NODE BASED COLLECTION (E.G. DUMPSTERS OR ALLEY CAT)
C    DIMENSIONED FOR UP TO 150 POINTS INCLUDING CENTRAL GARAGE OR
C    DISPOSAL/PROCESSING PLANT.
C    TIME IS THE SUM OF TRAVEL TIMES AND FIXED COLLECTION TIMES
C    AT EACH NODE.  ONE TYPE OF VEHICLE, ONE TIME LIMIT FOR ALL
C    ROUTES (ALTHOUGH THIS COULD BE MODIFIED IN THE PROGRAM.)
C
C
C
C    DATA REQUIREMENTS
C
C    FIRST CARD IN DATA DECK IS TOTAL NUMBER OF COLLECTION
C    POINTS (NDEL). FOLLOWED BY SET OF CARDS GIVING SHORTEST PATH TRAVEL
C    TIMES BETWEEN ALL NODES (DISPOSAL SITE IS INCLUDED AT THE END).
C    FORMAT FOR THESE CARDS IS 5X,10(F6.2,1X) SEQUENTIALLY.
C    THUS, FOR A 93 NODE PROBLEM THERE WOULD BE 94 SETS OF 10 CARDS
C    EACH.  THESE WOULD BE FOLLOWED BY 93 CARDS GIVING TIME
C    REQUIREMENTS FOR COLLECTION.  PRESENTLY, THIS IS A CAPACITY
C    AMOUNT FIRST FOLLOWED BY A FIXED TIME AND A VARIABLE TIME, WHICH
C    IS MULTIPLIED BY A COLLECTION RATE.
C    THE FINAL SET OF DATA IS THE MAXIMUM CAPACITY AND MAXIMUM TIME
C    (QM,TM) ON EACH ROUTE AND A RESET CARD FOR MULTIPLE RUNS.  ON THIS
C    CARD, A '1' IN COLUMN FIVE READS A NEW QM AND TM AND RESTARTS, A
C    '2' READS NEW DEMANDS AND RESTARTS, AND A '0' OR BLANK ENDS.
C
C
C
C
```

```
C     INPUT SECTION.  READS DATA.  SETS UP SAVINGS FILE S FOR USING       INPT0001
C     TRIANGULAR PATHS INSTEAD OF SIMPLE PATHS.  INITIALIZES ROUTES.      INPT0002
C     COMPUTES DELIVERY TIMES AT EACH NODE.  SEE CLARKE AND WRIGHT PAPER, INPT0003
C     OPERATIONS RESEARCH, 1965.                                          INPT0004
C                                                                         INPT0005
      COMMON DIST (150,150),S(150,150),K(150,150),T(150),CAP(150),        INPT0006
     * DEL(150)                                                           INPT0007
      COMMON FTIME(150),BTIME(150)                                        INPT0008
      COMMON NODE(150),Q(150)                                             INPT0009
      COMMON ORIG(150)                                                    INPT0010
      INTEGER ORIG                                                        INPT0011
      INTEGER RTEND,CAP,Q                                                 INPT0012
      INTEGER QNEW,QM                                                     INPT0013
      READ (5,1000) NDEL                                                  INPT0014
 1000 FORMAT (I5,F10.4,I5)                                                INPT0015
      N3=NDEL+1                                                           INPT0016
      N1=10*(N3/10)                                                       INPT0017
      DEL(1)=0.                                                           INPT0018
      N2=N1+1                                                             INPT0019
      N4=N2+1                                                             INPT0020
      Q(1)=0                                                              INPT0021
      KKKKK=0                                                             INPT0022
      DO 11 I=1,N3                                                        INPT0023
      IM=0                                                                INPT0024
   29 IQ=IM+1                                                             INPT0025
      IM=IM+10                                                            INPT0026
      READ (5,3000) (DIST(I,J),J=IQ,IM)                                   INPT0027
      IF (IM .LT.N1) GO TO 29                                             INPT0028
      READ (5,3000) (DIST(I,J),J=N2,N3)                                   INPT0029
   11 CONTINUE                                                            INPT0030
 3000 FORMAT (5X,10(F6.2,1X),5X)                                          INPT0031
   57 CONTINUE                                                            INPT0032
      READ (5,2000) (NODE(I),CAP(I),FTIME(I),BTIME(I),I=2,N3)             INPT0033
 2000 FORMAT (6X,I4,7X,I3,6X,F3.1,5X,F5.1)                                INPT0034
   56 CONTINUE                                                            INPT0035
      READ (5,1000) QM,TM                                                 INPT0036
      RTEND=0                                                           INPT0037
      TTD=0.                                                            INPT0038
      TTT=0.                                                            INPT0039
      KKKKK=KKKKK+1                                                     INPT0040
      COLT=.125                                                         INPT0041
      TFAC=1.25                                                         INPT0042
      SPD1=10.0/TFAC                                                    INPT0043
      SPD2=1.5*SPD1                                                     INPT0044
      SPD3=2.0*SPD1                                                     INPT0045
      WRITE (6,9300) KKKKK,COLT,SPD1,SPD2,SPD3,QM,TM                    INPT0046
 9300 FORMAT ('1RUN NUMBER ',I3//' COLLECTION TIME PER PERSON (MINUTES) INPT0047
     *',F10.4/' LINK SPEEDS IN MILES PER HOUR ',3F10.4/' MAXIMUM TRUCK C INPT0048
     *APACITY ',I5/' MAXIMUM ROUTE DURATION ',F10.4///)                 INPT0049
      DO 15 I=2,N3                                                      INPT0050
      DO 15 J=2,N3                                                      INPT0051
      S(I,J)=(DIST(1,J)+DIST(I,1)-DIST(I,J))/10.                        INPT0052
      S(I,J)=S(I,J)*TFAC                                                INPT0053
   15 CONTINUE                                                          INPT0054
      CALL ERASE (K,22500)                                              INPT0055
      DO 14 I=2,N3                                                      INPT0056
      K(I,1) =1                                                         INPT0057
      K(1,I)=1                                                          INPT0058
      ORIG(I)=I                                                         INPT0059
      DEL(I)=FTIME(I)+COLT*(RTIME(I)-10.)                               INPT0060
      T(I)=S(I,I)+DEL(I)                                                INPT0061
      Q(I)=CAP(I)                                                       INPT0062
      S(I,I)=0.                                                         INPT0063
      IF (Q(I) .LT. QM) GO TO 14                                        INPT0064
      Q(I)=Q(I)-QM                                                      INPT0065
      TTD=TTD+COLT*QM                                                   INPT0066
      TTT=(DIST(1,I)+DIST(I,1))/10.+TTT                                 INPT0067
      RTEND=RTEND+1                                                     INPT0068
      DEL(I)=DEL(I)-COLT*QM                                             INPT0069
      WRITE (6,8000) NODE(I)                                            INPT0070
 8000 FORMAT (' SINGLE PICKUP ROUTE TO NODE  ',I5/)                     INPT0071
   14 CONTINUE                                                          INPT0072
```

```
C     ALGORITHM SECTION.  CHOOSES MAXIMUM ALLOWABLE SAVINGS FOR         ALG00001
C     TRIANGULAR PATHS AND USES IT.  ROUTE CONSTRAINED TO BE UNDER TIME ALG00002
C     AND CAPACITY LIMITS FOR CHANGE TO BE 'ALLOWABLE'.  COMBINES THOSE ALG00003
C     ROUTES AND LOOKS FOR THE NEXT BEST.  'K' IS THE MATRIX LISTING    ALG00004
C     WHICH ARCS ARE IN USE (1) OR NOT(0).  T AND Q ARE THE TOTAL TIME  ALG00005
C     AND CAPACITY USED SO FAR ON EACH ROUTE. AND ARE STORED AT THE ROUTE ALG00006
C     ENDS WHERE NEW CONNECTIONS ARE ADDED.  ORIG IS THE POINTER        ALG00007
C     FROM INITIAL DELIVERY (ONE END) TO FINAL DELIVERY (THE OTHER) AND ALG00008
C     VICE VERSA.                                                       ALG00009
C                                                                       ALG00010
C                                                                       ALG00011
    1 SM=0.                                                             ALG00012
      DO 39 I=2,N3                                                      ALG00013
      DO 39 J=2,N3                                                      ALG00014
      IF (S(I,J) .LE. SM) GOTO 39                                       ALG00015
      TNEW=T(I)+T(J)-S(I,J)                                             ALG00016
      IF (TNEW .GT. TM) GO TO 39                                        ALG00017
      QNEW=Q(I)+Q(J)                                                    ALG00018
      IF (QNEW .GT. QM) GO TO 39                                        ALG00019
      SM=S(I,J)                                                         ALG00020
      L=I                                                               ALG00021
      M=J                                                               ALG00022
   39 CONTINUE                                                          ALG00023
      IF (SM .LT. 0.1) GO TO 999                                        ALG00024
      K(L,M)=1                                                          ALG00025
      K(1,M) =0                                                         ALG00026
      K(L,1) =0                                                         ALG00027
      ITME=ORIG(L)                                                      ALG00028
      Q(ITME)=Q(M)+Q(L)                                                 ALG00029
      Q(ORIG(M))=Q(ITME)                                                ALG00030
      T(ITME)=T(M)+T(L)-S(L,M)                                          ALG00031
      T(ORIG(M))=T(ITME)                                                ALG00032
      S(ORIG(M),ITME)=0.                                                ALG00033
      ORIG(ITME)=ORIG(M)                                                ALG00034
      ORIG(ORIG(M))=ITME                                                ALG00035
      DO 40 I=2,N3                                                      ALG00036
      S(L,I)=0.                                                         ALG00037
      S(I,M)=0.                                                         ALG00038
   40 CONTINUE                                                          ALG00039
      GO TO 1                                                           ALG00040
C                                                                       ALG00041
C                                                                       ALG00042
C                                                                       ALG00043
```

```
C     OUTPUT SECTION.  TAKES FINAL K MATRIX, FOLLOWS THE DIRECTED PATH        OPUT0001
C     STARTING AT THE BEGINNING AND CONTINUING TO THE END.  PRINTS OUT        OPUT0002
C     THE ROUTE NUMBER AND, FOR EACH DELIVERY, THE NODE NUMBER, THE           OPUT0003
C     CAPACITY USED, ELAPSED TIME SINCE THE BEGINNING OF THE ROUTE,           OPUT0004
C     TRAVEL TIME FROM THE PREVIOUS NODE, AND DELIVERY TIME AT THAT NODE.     OPUT0005
C     THIS INFORMATION CAN ALSO BE PUNCHED ON CARDS, IF DESIRED.              OPUT0006
C                                                                             OPUT0007
C                                                                             OPUT0008
C                                                                             OPUT0009
  999 CONTINUE                                                                OPUT0010
      DO 21 I=2,N3                                                            OPUT0011
      IF (K(1,I)  .EQ. 0) GO TO 21                                            OPUT0012
      IDEL=0                                                                  OPUT0013
      RTENO=RTENO+1                                                           OPUT0014
      J=1                                                                     OPUT0015
      TD=0.                                                                   OPUT0016
      ELAPST=0.                                                               OPUT0017
      IK=I                                                                    OPUT0018
      ISEQ=0                                                                  OPUT0019
      WRITE (6,4000) RTENO                                                    OPUT0020
 4000 FORMAT ('1ROUTE NUMBER',T20,I5///)                                      OPUT0021
      WRITE (6,6000)                                                          OPUT0022
 6000 FORMAT ('  #  NODE   PEOPLE   ELAPSED TIME   TRAVEL TIME FROM PREV      OPUT0023
     *IOUS NODE   COLLECTION TIME'//)                                         OPUT0024
   22 ISEQ=ISEQ+1                                                             OPUT0025
      DOUT=DIST(J,IK)*TFAC/10.                                                OPUT0026
      ELAPST=ELAPST+DEL(J)+DOUT                                               OPUT0027
      IF (IK .EQ. 1)  GO TO 24                                                OPUT0028
      ICAP=CAP(I)                                                             OPUT0029
      IF (CAP(IK).LT.QM) GO TO 25                                             OPUT0030
      ICAP=ICAP-QM                                                            OPUT0031
   25 IDEL=IDEL+ICAP                                                          OPUT0032
      WRITE (6,5000) ISEQ,NODE(IK),ICAP,ELAPST,DOUT,DEL(IK)                   OPUT0033
      J=IK                                                                    OPUT0034
      DO 23 MM=1,N3                                                           OPUT0035
      IF (K(J,MM) .EQ.0) GO TO 23                                             OPUT0036
      IK=MM                                                             OPUT0037
      MM=N3                                                             OPUT0038
   23 CONTINUE                                                          OPUT0039
      GO TO 22                                                          OPUT0040
   24 WRITE (6,7000) ELAPST,IDEL                                        OPUT0041
 7000 FORMAT (' BACK TO DEPOT. ELAPSED TIME    ',F10.4,' TOTAL COLLECTION OPUT0042
     *S    ',I5)                                                        OPUT0043
      TD=TD+DEL(IK)                                                     OPUT0044
      TT=ELAPST-TD                                                      OPUT0045
      WRITE (6,9400) TD,TT                                              OPUT0046
 9400 FORMAT (' '/' DELIVERY TIME TOTAL ',F10.4/' TRAVEL TIME TOTAL ',F1 OPUT0047
     *0.4)                                                              OPUT0048
      TTT=TTT+TT                                                        OPUT0049
      TTD=TTD+TD                                                        OPUT0050
   21 CONTINUE                                                          OPUT0051
      T1=TTT+TTD                                                        OPUT0052
      DPER=100.*TTD/T1                                                  OPUT0053
      TPER=100.*TTT/T1                                                  OPUT0054
      WRITE (6,9500) T1,TTD,DPER,TTT,TPER                               OPUT0055
 9500 FORMAT (' '/////' TOTAL TIME FOR ALL ROUTES     ',F10.4//' DELIVERY OPUT0056
     *TIME IS ',F10.4,' MINUTES OR ', F6.3,' PERCENT'/' TRAVEL TIME IS ' OPUT0057
     *,F10.4,' MINUTES OR ',F6.3,' PERCENT')                            OPUT0058
 5000 FORMAT (1X,I3,I5,T14,I3,T24,F10.4,T48,F10.4,T70,F10.4)            OPUT0059
C                                                                       OPUT0060
C                                                                       OPUT0061
```

```
C     RECYCLE FOR MULTIPLE RUNS ON ONE JOB.  KCONT=1 WILL ASK FOR NEW           RRUN0001
C     QM AND TM AND RESTART.  KCONT=2 WILL REQUIRE NEW CAPACITIES AND NODE      RRUN0002
C     TIMES AND QM AND TM.  KCONT=0 (OR BLANK) WILL EXIT.                       RRUN0003
C                                                                               RRUN0004
C                                                                               RRUN0005
   76 CONTINUE                                                                  RRUN0006
      READ (5,1000) KCONT                                                       RRUN0007
        IF (KCONT .LT. 0) GO TO 57                                              RRUN0008
        IF (KCONT .GT. 0) GO TO 56                                              RRUN0009
      WRITE (5,1000) QM,TM                                                      RRUN0010
      END                                                                       RRUN0011
```

## VIII. The Breakdown and Overload Simulation

The Breakdown and Overload Simulation Model is written in GPSS/360, the IBM version of the General Purpose Simulation System. GPSS is made up of blocks which control the flow of physical items or information (in this case, trucks and assignments for them). Blocks are defined in the manuals listed in the references, and will not be discussed further here.

Probability distributions in the model include

BTIME: the probability of a breakdown at a particular time during a day's work

DMAND: the probability of a specific number of stops on a day's work

REPAR: the distribution of repair times per breakdown

HOURS: the distribution of time required per stop

Output information includes

OVERS: a table of leftover (unserved) demands

COST: a table of the cost of service by days

HOUR: total hours required (histogram)

BADS: number of routes not completed (histogram)

REP: repair times (histogram)

AVAIL: number of avialable trucks (queue)

BROKE: number of trucks in shop (queue)

ROUTE: number of trucks on routes (storage: capacity=10)

DAY: day in progress (facility)

Note: different data is provided for queues, tables, etc. Refer to manual.

Flow transfer points in the model include

READY: truck is available for use

DAYST: start of day

CLT: compute required collection time

NOT: demands can not be met during day

SKIP: route is a continuation of earlier

MEET: demands can be met during normal day

OVTM: add overtime cost

BDOWN: breakdown occurred

NUDAY: beginning of day

LBLK: assign trucks if needed and available

RETRN: wait until assignment required

ENDAY: end of day, compute accounts

BLAG: lag until new truck reaches scene after breakdown.

```
       SIMULATE                                                                   BRDN0001
*                                                                                 BRDN0002
*                                                                                 BRDN0003
*                                                                                 BRDN0004
* SIMULATION OF DISPATCHING FOR COVERAGE OF EXCESS LOADS IN COLLECTION            BRDN0005
*    DISTRICTS AND BREAKDOWNS OF COLLECTION TRUCKS.                               BRDN0006
*    REFER TO FLOW CHARTS AS NECESSARY.                                           BRDN0007
*    LANGUAGE IS GPSS/360                                                         BRDN0008
*                                                                                 BRDN0009
*                                                                                 BRDN0010
* INPUTS:  NUMBER OF TRUCKS (BLOCK 1);  NUMBER OF ROUTES (BLOCK 48);              BRDN0011
*   MEAN TIME BETWEEN BREAKDOWNS (FUNCTION BTIME); DISTRIBUTION                   BRDN0012
*   OF REPAIR TIMES (FUNCTION REPAR); DISTRIBUTION OF NUMBER OF STOPS             BRDN0013
*   (FUNCTION DMAND); TIME REQUIRED FOR EACH STOP PDF (FUNCTION HOUS);            BRDN0014
*   WAGE RATE AND OVERTIME MULTIPLIER (FVARIABLE 8 & 9); AND REPAIR               BRDN0015
*   COSTS (FVARIABLE 10);  ALSO: POLICY INPUTS -- MAAXIMUM OVERTIME               BRDN0016
*   OF 3/2 HOURS, LATEST DISPATCHING TIME AT 6 1/2 HOURS,                         BRDN0017
*   REPORT TOO MANY DEMANDS AT 4 HOURS.  ALL TIMES SHOWN IN UNITS OF              BRDN0018
*   TEN MINUTES.                                                                  BRDN0019
 ROUTE STORAGE     10                                                             BRDN0020
 BTIME FUNCTION    RN1,C2                                                         BRDN0021
0     0     .04    58                                                             BRDN0022
 DMAND FUNCTION    RN2,C4                                                         BRDN0023
0     1     .15    41    .85    57    1     97                                    BRDN0024
 REPAR FUNCTION    RN4,C7                                                         BRDN0025
0     12    .1     18    .2     30    .8    96    .9    240   .95   384           BRDN0026
.98   528                                                                         BRDN0027
 HOURS FUNCTION    RN3,C5                                                         BRDN0028
0     0     .1     1     .6     1.5   .9    2     1     3                         BRDN0029
*                                                                                 BRDN0030
*  TABLES FOR OUTPUT -- DEFINITIONS                                               BRDN0031
*                                                                                 BRDN0032
 OVERS TABLE       X6,0,10,10                                                     BRDN0033
 COST  TABLE       X7,500,25,10                                                   BRDN0034
 HOUR  TABLE       P5,48,2,20                                                     BRDN0035
 BADS  TABLE       P1,0,1,10                                                      BRDN0036
```

```
REP    TABLE       P7,0,20,400                                                   BRDN0037
*                                                                                BRDN0038
*  VEHICLE PROCESS.  EACH VEHICLE TRAVELS ON ROUTES AND                          BRDN0039
*   BREAKS DOWN DEPENDING ON THE DISPATCHER AND RANDOM EVENTS*                   BRDN0040
*                                                                                BRDN0041
       GENERATE    ,,1,12                                                        BRDN0042
       LOGIC R     1                                                             BRDN0043
READY  QUEUE       AVAIL            HOLD UNTIL NEEDED IN QUEUE                   BRDN0044
       GATE LS     1                WAIT UNTIL DISPATCHER REQUESTS               BRDN0045
       LOGIC R     1                TELL DISPATCHER REQUEST FULFILLED            BRDN0046
       ASSIGN      5,0                                                           BRDN0047
       ENTER       ROUTE            START A ROUTE                                BRDN0048
       DEPART      AVAIL                                                         BRDN0049
       ASSIGN      4,V4             ASSIGN A BREAKDOWN TIME                      BRDN0050
     4 FVARIABLE   FN$BTIME                                                      BRDN0051
       TEST G      C1,X1,DAYST      IS THIS THE START OF THE DAY? Y-DAYST        BRDN0052
       ASSIGN      5,X6             ASSIGN UNFILLED DEMANDS TO TRUCK             BRDN0053
       SAVEVALUE   6,0              EMPTY UNFILLED DEMANDS LIST                  BRDN0054
       ADVANCE     3,1              TAKE TIME GETTING STARTED                    BRDN0055
       TRANSFER    ,NOT                                                          BRDN0056
DAYST  ASSIGN      12,V2                                                         BRDN0057
       ASSIGN      12+,FN$DMAND                                                  BRDN0058
CLT    ASSIGN      5+,FN$HOURS      ADD TIME FOR ONE STOP                        BRDN0059
       LOOP        12,CLT           LOOP THROUGH ALL STOPS TO GET TOTAL          BRDN0060
     2 FVARIABLE   X2/10                                                         BRDN0061
     2 FVARIABLE   (5+X2)/10                                                     BRDN0062
       TABULATE    HOUR             LIST TIME REQUIREMENTS FOR OUTPUT            BRDN0063
NOT    TEST GE     P5,V3,MEET       IF TIME IS SUFFICIENT, GO TO MEET            BRDN0064
*                                                                                BRDN0065
*  NOT-MEET DEMANDS ON ROUTE SECTION                                             BRDN0066
*                                                                                BRDN0067
       TEST GE     V3,57,SKIP       IF FILL-IN ROUTE, GO TO SKIP                 BRDN0068
       TEST G      P4,24,BDOWN      IF BREAKDOWN BEFORE REPORT,BDOWN             BRDN0069
       ADVANCE     24               WORK UNTIL LUNCH, THEN CALL DISP.            BRDN0070
       SAVEVALUE   6+,V6            TELL HIM THAT YOU                            BRDN0071
     6 FVARIABLE   P5-57            CAN'T MEET, SO THAT HE WILL ASSIGN AN        BRDN0072
```

```
      LOGIC S    2                  EXTRA TRUCK                                BRDN0073
SKIP  TEST G     P4,57,BDOWN                                                   BRDN0074
      ADVANCE    V3                 ADVANCE TO END OF DAY TIME LIMIT           BRDN0075
      SAVEVALUE  7+,66                                                         BRDN0076
    9 FVARIABLE  V8+91*(P5-48)/6C     AND GET READY TO START A NEW DAY         BRDN0077
      LEAVE      ROUTE                                                         BRDN0078
      TRANSFER   ,READY                                                        BRDN0079
*                                                                              BRDN0080
*   MEET DEMANDS                                                               BRDN0081
*                                                                              BRDN0082
MEET  TEST G     P4,P5,BDOWN        BREAKDONW BEFORE DONE?                     BRDN0083
      ADVANCE    P5                 NO, SO DO ROUTE AND                        BRDN0084
      TEST LE    V6,C,OVTM          COMPUTE COSTS (MINIMUM OF EIGHT            BRDN0085
      SAVEVALUE  7+,V8              HOURS PAY) AND END ROUTE FOR THE DAY       BRDN0086
      SAVEVALUE  7+,V8              EIGHT HOURS) AND END ROUTE FOR THE DAY     BRDN0087
    8 FVARIABLE  52                                                            BRDN0088
      LEAVE      ROUTE                                                         BRDN0089
      TRANSFER   ,READY                                                        BRDN0090
OVTM  SAVEVALUE  7+,V9                                                         BRDN0091
      LEAVE      ROUTE                                                         BRDN0092
      TRANSFER   ,READY                                                        BRDN0093
*                                                                              BRDN0094
*  BREAKDON SECTION                                                            BRDN0095
*                                                                              BRDN0096
BDOWN QUEUE      BROKE              TRUCK HAS BROKEN DOWN                      BRDN0097
      ADVANCE    P4                 DO ROUTE TO THAT POINT                     BRDN0098
      SAVEVALUE  7+,V10             ADD COST OF BREAKDOWN                      BRDN0099
   10 FVARIABLE  V8+25                                                         BRDN0100
      LEAVE      ROUTE              GET OUT OF ROUTE                           BRDN0101
      SAVEVALUE  6+,V7                                                         BRDN0102
    7 FVARIABLE  P5-P4                                                         BRDN0103
      LOGIC S    2                                                             BRDN0104
      ASSIGN     7,V5               ASSIGN A REPAIR TIME                       BRDN0105
      ADVANCE    P7                 DO REPAIRS                                 BRDN0106
      TABULATE   REP                                                           BRDN0107
    5 FVARIABLE  FN$REPAR                                                      BRDN0108
```

```
         DEPART     BROKE            COME BACK TO AVAILABLE                        BRDN0109
         TRANSFER   ,READY                                                         BRDN0110
*                                                                                  BRDN0111
*  DISPATCHER PROCESS.  ONE ENTRY FOR EACH DAY.  ASSIGNS                           BRDN0112
*   TRUCKS TO ROUTES, THEN WAITS TO ASSIGN THEM FURTHER IF RANDOM                  BRDN0113
*  THINGS HAPPEN                                                                   BRDN0114
*                                                                                  BRDN0115
         GENERATE   144,,2                                                         BRDN0116
NUDAY    SEIZE      DAY              SAVE THE CLOCK TIME FOR COMPARISONS           BRDN0117
         SAVEVALUE  1,C1             TEN ROUTES DESIRED                            BRDN0118
         ASSIGN     6,10             CLEAR COSTS                                   BRDN0119
         SAVEVALUE  7,0              SET UP LEFTOVER DEMANDS                       BRDN0120
         SAVEVALUE  2+,X6            CLEAR UNFILLED                                BRDN0121
         SAVEVALUE  6,C              ENOUGH TRUCKS FOR ROUTES? Y -- LBLK           BRDN0122
         TEST G     P6,Q$AVAIL,LBLK                                                BRDN0123
         LOGIC S    2                SET DEMANDS TO BE FILLED SWITCH               BRDN0124
         SAVEVALUE  6,FN$DMAND                                                     BRDN0125
         ASSIGN     6,Q$AVAIL        TELL HOW MANY CAN BE USED                     BRDN0126
LBLK     LOGIC S    1                ASSIGN A TRUCK                                BRDN0127
         GATE LR    1                WAIT                                          BRDN0128
         LOOP       6,LBLK           ASSIGN ANOTHER TRUCK                          BRDN0129
RETRN    TEST E     BV1,1            IS THERE ANYTHING TO DO?                      BRDN0130
       2 BVARIABLE  (Q$AVAIL'G'C)*LS2                                              BRDN0131
       1 BVARIABLE  BV2+(V3'L'18)                                                  BRDN0132
         TEST E     BV2,1,ENDAY      IF TRUE, ASSIGN A TRUCK. FALSE -- DAY         BRDN0133
         LOGIC S    1                IS OVER (NO MORE ASSIGNMENTS)                 BRDN0134
         LOGIC R    2                                                              BRDN0135
         ASSIGN     1+,1             ASSIGN TRUCK, COUNT BAD ROUTES                BRDN0136
         TRANSFER   ,RETRN                                                         BRDN0137
ENDAY    SAVEVALUE  2,0                                                            BRDN0138
         TEST E     BV3,1                                                          BRDN0139
       3 BVARIABLE  SE$ROUTE                                                       BRDN0140
         TEST NE    X6,C,BLAG                                                      BRDN0141
         PRINT      ,,C                                                            BRDN0142
         PRINT      6,6,X                                                          BRDN0143
BLAG     SAVEVALUE  2,0                                                            BRDN0144
```

```
          RELEASE     DAY             END THAT DAY'S WORK                                   BRDN0145
          TABULATE    OVERS                                                                 BRDN0146
          TABULATE COST               COLLECT DATA ON OPERATION                             BRDN0147
          TABULATE    BADS                                                                  BRDN0148
        3 FVARIABLE   57+X1-C1                                                              BRDN0149
        1 FVARIABLE   V3+90                                                                 BRDN0150
          TERMINATE   1                                                                     BRDN0151
          START       10,NP                                                                 BRDN0152
          RESET                                                                             BRDN0153
          START       100                                                                   BRDN0154
          RMULT       1,1,1,1                                                               BRDN0155
          CLEAR                                                                             BRDN0156
    DMAND FUNCTION    RN2,C4                                                                BRDN0157
0     1      .15      37    .85   53    1     89                                            BRDN0158
          START       10,NP           RERUN WITH NEW LEVEL OF DEMANDS                       BRDN0159
          RESET                                                                             BRDN0160
          START       100                                                                   BRDN0161
          RMULT       1,1,1,1                                                               BRDN0162
          CLEAR                                                                             BRDN0163
    DMAND FUNCTION    RN2,C4                                                                BRDN0164
0     1      .15      33    .85   49    1     81                                            BRDN0165
          START       10,NP           RERUN WITH NEW LEVEL OF DEMANDS                       BRDN0166
          RESET                                                                             BRDN0167
          START       100                                                                   BRDN0168
          554                                                                               BRDN0169
```

## IX. The Regional Processing, Haul, and Disposal Model

The regional processing, haul, and disposal model is a large separable programming model, and was described in detail in chapter 9 of the first volume. We have included a listing below of the equations in its formulation for reference, and a list of the variables used. Rows and columns in the data file are coded by a set of indicator letters, giving the type of row, the facility or generating point concerned, and the time period. Time periods are 7,8, or 9, short for "1970","1980",or"1990", the three snapshots which cover the life of the planning horizon. A list of generating points and facilities is given below:

| Generating Point | |
|---|---|
| Boston | B |
| Cambridge | C |
| Malden | E |
| Stoneham | S |
| Woburn | R |
| Arlington | F |
| Lexington | L |
| Waltham | T |
| Newton | N |
| Brighton | M |
| Dedham | D |
| Milton | Q |
| Walpole | P |
| Braintree | Y |
| Canton | H |
| Needham | W |

| Facility | |
|---|---|
| Boston (incin.) | I |
| Winchester (incin.) | F |
| Watertown (incin.) | V |
| Brookline (incin.) | O |
| Newton (incin.) | N |
| Wellesley (incin.) | W |
| Dedham (incin.) | P |
| Braintree (incin.) | E |
| Cambridge (transfer) | R |
| Saugus (landfill) | S |
| Lexington (landfill) | L |
| Milton (landfill) | G |
| Quincy (landfill) | Q |
| Holbrook (landfill) | M |
| Walpole (landfill) | D |

The form of the model derived in this report is as follows:

$$\text{MIN} \sum_{i=1}^{m} \sum_{t=1}^{p} \lambda_t \cdot \gamma_{it}(P_{it}) + \sum_{t=1}^{p} \sum_{j=1}^{n} \sum_{i=1}^{m} \lambda_t C_{ijt} \cdot X_{ijt}$$

$$+ \sum_{t=1}^{p} \sum_{i=1}^{m} \lambda_t \cdot F_{it} \cdot (\gamma_{it}) + \sum_{t=1}^{p} \sum_{h=1}^{m-a} \sum_{g=1}^{a} \lambda_t \cdot C^{*}_{ght} \cdot T_{ght} \qquad (1)$$

$$\text{s.t.} \quad \sum_{i=1}^{n} X_{ijt} \geq D_{jt} \qquad \forall\, j,t \qquad (2)$$

$$\sum_{j=1}^{n} X_{ijt} - P_{it} \leq 0 \qquad \forall\, i,t \qquad (3)$$

$$P_{gt} - \sum_{t=1}^{t} y_{gt} - Q_{go} \leq 0 \qquad \forall\, g,t \qquad (4a)$$

$$\sum_{t=1}^{t} P_{ht} - \sum_{t=1}^{t} y_{ht} - Q^{*}_{ho} \leq 0 \qquad \forall\, h,t \qquad (4b)$$

$$\alpha_g P_{gt} - \sum_{h=1}^{m-a} T_{ght} \leq 0 \qquad \forall\, g,t \qquad (5)$$

$$\sum_{t=1}^{p} \sum_{j=1}^{n} \sum_{i=1}^{m} D_{ij} X_{ijt} + \sum_{t=1}^{p} \sum_{h=1}^{m-a} \sum_{g=1}^{a} D_{gh} \cdot T_{ght} \leq A \qquad (6)$$

$$\sum_{t=1}^{p} \sum_{j=1}^{n} \sum_{i=1}^{m} E_{ij} \cdot X_{ijt} \leq B \qquad (7)$$

$$\sum_{t=1}^{p} y_{it} \leq S_i \qquad (8)$$

$$X_{ijt} \geq 0 \qquad \forall\, i,j,t$$

$$T_{ght} \geq 0 \qquad \forall\, g,h,t$$

$$y_{it} \geq 0 \qquad \forall\, i,t$$

$$P_{it} \geq 0 \qquad \forall\, i,t$$

where $X_{ijt}$ = units of waste shipped from j to i in period t

$y_{it}$ = capacity added to facility i at the beginning of period t

$S_i$ = total expansion capacity of site i

$P_{it}$ = units of waste processed at site i in period t

$T_{ght}$ = units of waste shipped from treatment site g to final disposal site h in period t

$m$ = number of feasible facility sites

$n$ = number of demand areas

$p$ = number of time periods included in analysis

$a$ = number of intermediate processing centers g

$m-a$ = number of final disposal sites h

$Q_{go}$ = initial capacity at intermediate facility g

$Q^*_{ho}$ = initial capacity at final disposal site h

$\alpha_g$ = weight reduction factor for intermediate facility g

$\lambda_t$ = financial discount factor for period t

$F_{it}(y_{it})$ = cost of expanding capacity at site i by $y_{it}$ units in period t

$C_{ijt}$ = unit shipping cost between j and i in period t

$\gamma_{it}(P_{it})$ = cost of processing $P_{it}$ units at site i in period t

$C^*_{ght}$ = unit transshipping cost between sites g and h in period t

$D_{jt}$ = waste load generated at site j in year t

$D_{ij}$ = distance between site i and demand area j

There are minor differences between the programmed model and the above description, primarily to give faster operation at the cost of transparency and to include the separable cost functions for facility expansion. The tableau below gives some feeling for the structure of the problem.

This is followed on the next page by a description of the internal variables as listed in the picture, and then bey a translation between them, the coded model, and the equation listing above.

COLUMNS

| ROWS | PR | Y | D | W | Q | DQ | S | T | | RHS |
|---|---|---|---|---|---|---|---|---|---|---|
| COST | | -1 | $\delta$ | $\omega$ | | | $\theta$ | $\eta$ | $\leq$ | 0 |
| G | | | | | | | 1 | | $\geq$ | C |
| M | $-\alpha$ | | | | | | | 1 | $\geq$ | 0 |
| F | | | | | | | | 1 | $\leq$ | B |
| D | | | -1 | | | 1 | | | = | 0 |
| X | 1 | | | -1 | | | | | = | 0 |
| C | | | | | -1 | -1 | 1 | 1 | $\leq$ | 0 |
| NPV | | $\beta, \gamma, \varepsilon$ | | | | | | | | |
| DIST | | | | | | | $\phi$ | | | |
| EQ | | | | | | | 1 | | $\leq$ | A |
| R | -1 | | | | | | 1 | | $\leq$ | 0 |

Row Variables

| | |
|---|---|
| DIST: | Total distance shipped (ton miles) |
| NPV | New present value |
| EQ: | Equity Equation |
| COST" | $y_+ \geq$ total cost of all items in year X |
| G: | all waste generated must be shipped |
| M: | amount transshipped from processing plants $\geq$ remainder after processing |
| F: | amount transshipped to landfill X is constrained |
| D: | capacity expansion DQ = $\Sigma$ separable D's |
| C: | Capacity of site<br>Landfills $Q_T = Q_0 +^{\varepsilon}$ expansion - shipments<br>Processing $Q_0$ + expansion $\geq$ shipments |
| R: | Process at least as much as you ship |
| X: | row for computing separable processing cost |

Column Variables

| | |
|---|---|
| $S_{ijt}$: | shipments from generating site i to processing/disposal site j in time + (tons) |
| $T_{jkt}$: | shipments from processing site j to disposal site k in time + (tons) |
| $Q_j$ : | capacity of site j (tons/year or tons) |
| $DQ_{jt}$: | total added capacity of $j^{byt}$ (tons/year or tons) |
| $D_{jt}$: | total added capacity of j in year + (tons/year or tons) |
| $Y_t$: | total cost at year t |
| $PR_{kt}$ | waste processed at site k in year + |
| W: | separable variable for nonlinear processing cost |

Coefficients

| | |
|---|---|
| $\beta\gamma\varepsilon$ | discount rate $\lambda_t$ |
| $\omega$ | $\gamma_{it}(P_{it})$ |
| $\theta$ | $C_{ijt}$ |
| $\delta$ | $F_{it}$ |
| $\eta$ | $C_{ght}{}^*$ |
| $\alpha$ | $\alpha_g$ |
| $\phi$ | distance |

TRANSLATION TABLE

| Model Variable (example) | | Short Form | Equation Number or Name |
|---|---|---|---|
| Columns: | SMV8 | S | $X_{ijt}$ |
| | TFL7 | T | $T_{ght}$ |
| | DQD9 | DQ | none -- separable construction cost |
| | QCOS7 | Q | $Q_{go}, Q^{*}_{ho}$ |
| | DD7A | D | separable costs |
| | PRD7 | PR | $P_{it}$ |
| | WI8B | W | separable operating cost |
| | Y7 | Y | converts from cost to NPV |
| Rows: | COST7 | COST | (1): cost of time period |
| | NPV4 | NPV | (1): net present value of cost |
| | DIST | DIST | (6): total distance shipped |
| | EQ | EQ | (7): equity |
| | DD7, LD9 | D | (4): capacity expansion |
| | XI8 | X | (1): processing cost |

## Translation Table (cont.)

| Model Variable (example) | Short Form | Equation Number or Name |
|---|---|---|
| GB9 | G | (2):demands |
| CM7 | C | (4): capacity sufficient |
| ME8 | M | (5): transshipment |
| RV7 | R | (3): handle all waste |
| FE | F | ?: transshipment limit |

```
         PROGRAM                                                       CNTL0001
         INITIALZ                                                      CNTL0002
         MOVE (XDATA,'GRBG')                                           CNTL0003
         MOVE (XPBNAME,'REFUSE')                                       CNTL0004
         CONVERT                                                       CNTL0005
         SETUP ('BOUND','SEPBOUND')                                    CNTL0006
         MOVE(XRHS,'WASTE')                                            CNTL0007
         MOVE(XOBJ,'DIST')                                             CNTL0008
         OPTIMIZE                                                      CNTL0009
         SOLUTION('BASIS')                                             CNTL0010
         EXIT                                                          CNTL0011
         PEND                                                          CNTL0012
//MPSEXEC.SYSIN DD *,DCB=(RECFM=FB,LRECL=80,BLKSIZE=2000)              CNTL0013
NAME          GRBG                                                     CNTL0014
```

```
ROWS                                                                    ROWS0001
 N  NPV                                                                 ROWS0002
 N  NPV12                                                               ROWS0003
 N  NPV4                                                                ROWS0004
 N  DIST                                                                ROWS0005
 L  EQ                                                                  ROWS0006
 E  DD7                                                                 ROWS0007
 E  DD8                                                                 ROWS0008
 E  DD9                                                                 ROWS0009
 E  ED7                                                                 ROWS0010
 E  ED8                                                                 ROWS0011
 E  ED9                                                                 ROWS0012
 E  FD7                                                                 ROWS0013
 E  FD8                                                                 ROWS0014
 E  FD9                                                                 ROWS0015
 E  GD71                                                                ROWS0016
 E  GD81                                                                ROWS0017
 E  GD91                                                                ROWS0018
 E  ID7                                                                 ROWS0019
 E  ID8                                                                 ROWS0020
 E  ID9                                                                 ROWS0021
 E  LD7                                                                 ROWS0022
 E  LD8                                                                 ROWS0023
 E  LD9                                                                 ROWS0024
 E  MD7                                                                 ROWS0025
 E  MD8                                                                 ROWS0026
 E  MD9                                                                 ROWS0027
 E  ND7                                                                 ROWS0028
 E  ND8                                                                 ROWS0029
 E  ND9                                                                 ROWS0030
 E  OD7                                                                 ROWS0031
 E  OD8                                                                 ROWS0032
 E  OD9                                                                 ROWS0033
 E  PD7                                                                 ROWS0034
 E  PD8                                                                 ROWS0035
 E  PD9                                                                 ROWS0036
```

```
E   QD7                                                            ROWS0037
E   QD8                                                            ROWS0038
E   QD9                                                            ROWS0039
E   RD71                                                           ROWS0040
E   RD81                                                           ROWS0041
E   RD91                                                           ROWS0042
E   SD7                                                            ROWS0043
E   SD8                                                            ROWS0044
E   SD9                                                            ROWS0045
E   VD7                                                            ROWS0046
E   VD8                                                            ROWS0047
E   VD9                                                            ROWS0048
E   WD7                                                            ROWS0049
E   WD8                                                            ROWS0050
E   WD9                                                            ROWS0051
E   XD7                                                            ROWS0052
E   XD8                                                            ROWS0053
E   XD9                                                            ROWS0054
E   XE7                                                            ROWS0055
E   XE8                                                            ROWS0056
E   XE9                                                            ROWS0057
E   XF7                                                            ROWS0058
E   XF8                                                            ROWS0059
E   XF9                                                            ROWS0060
E   XG7                                                            ROWS0061
E   XG8                                                            ROWS0062
E   XG9                                                            ROWS0063
E   XI7                                                            ROWS0064
E   XI8                                                            ROWS0065
E   XI9                                                            ROWS0066
E   XL7                                                            ROWS0067
E   XL8                                                            ROWS0068
E   XL9                                                            ROWS0069
E   XM7                                                            ROWS0070
E   XM8                                                            ROWS0071
E   XM9                                                            ROWS0072
```

```
 E  XN7                                                                 ROWS0073
 E  XN8                                                                 ROWS0074
 E  XN9                                                                 ROWS0075
 E  XO7                                                                 ROWS0076
 E  XO8                                                                 ROWS0077
 E  XO9                                                                 ROWS0078
 E  XP7                                                                 ROWS0079
 E  XP8                                                                 ROWS0080
 E  XP9                                                                 ROWS0081
 E  XQ7                                                                 ROWS0082
 E  XQ8                                                                 ROWS0083
 E  XQ9                                                                 ROWS0084
 E  XR7                                                                 ROWS0085
 E  XR8                                                                 ROWS0086
 E  XR9                                                                 ROWS0087
 E  XS7                                                                 ROWS0088
 E  XS8                                                                 ROWS0089
 E  XS9                                                                 ROWS0090
 E  XV7                                                                 ROWS0091
 E  XV8                                                                 ROWS0092
 E  XV9                                                                 ROWS0093
 E  XW7                                                                 ROWS0094
 E  XW8                                                                 ROWS0095
 E  XW9                                                                 ROWS0096
 L  COST7                                                               ROWS0097
 L  COST8                                                               ROWS0098
 L  COST9                                                               ROWS0099
 L  COST71                                                              ROWS0100
 L  COST81                                                              ROWS0101
 L  COST91                                                              ROWS0102
 N  ROW1                                                                ROWS0103
 N  ROW2                                                                ROWS0104
 G  GB7                                                                 ROWS0105
 G  GB8                                                                 ROWS0106
 G  GB9                                                                 ROWS0107
 G  GC7                                                                 ROWS0108
 G   GC8                                                                  ROWS0109
 G   GC9                                                                  ROWS0110
 G   GD7                                                                  ROWS0111
 G   GD8                                                                  ROWS0112
 G   GD9                                                                  ROWS0113
 G   GE7                                                                  ROWS0114
 G   GE8                                                                  ROWS0115
 G   GE9                                                                  ROWS0116
 G   GF7                                                                  ROWS0117
 G   GF8                                                                  ROWS0118
 G   GF9                                                                  ROWS0119
 G   GH7                                                                  ROWS0120
 G   GH8                                                                  ROWS0121
 G   GH9                                                                  ROWS0122
 G   GL7                                                                  ROWS0123
 G   GL8                                                                  ROWS0124
 G   GL9                                                                  ROWS0125
 G   GM7                                                                  ROWS0126
 G   GM8                                                                  ROWS0127
 G   GM9                                                                  ROWS0128
 G   GN7                                                                  ROWS0129
 G   GN8                                                                  ROWS0130
 G   GN9                                                                  ROWS0131
 G   GP7                                                                  ROWS0132
 G   GP8                                                                  ROWS0133
 G   GP9                                                                  ROWS0134
 G   GQ7                                                                  ROWS0135
 G   GQ8                                                                  ROWS0136
 G   GQ9                                                                  ROWS0137
 G   GR7                                                                  ROWS0138
 G   GR8                                                                  ROWS0139
 G   GR9                                                                  ROWS0140
 G   GS7                                                                  ROWS0141
 G   GS8                                                                  ROWS0142
 G   GS9                                                                  ROWS0143
 G   GT7                                                                  ROWS0144
```

```
G  GT8                                                                  ROWS0145
G  GT9                                                                  ROWS0146
G  GW7                                                                  ROWS0147
G  GW8                                                                  ROWS0148
G  GW9                                                                  ROWS0149
G  GY7                                                                  ROWS0150
G  GY8                                                                  ROWS0151
G  GY9                                                                  ROWS0152
L  CD7                                                                  ROWS0153
L  CD8                                                                  ROWS0154
L  CD9                                                                  ROWS0155
L  CE7                                                                  ROWS0156
L  CE8                                                                  ROWS0157
L  CE9                                                                  ROWS0158
L  CF7                                                                  ROWS0159
L  CF8                                                                  ROWS0160
L  CF9                                                                  ROWS0161
L  CG7                                                                  ROWS0162
L  CG8                                                                  ROWS0163
L  CG9                                                                  ROWS0164
L  CI7                                                                  ROWS0165
L  CI8                                                                  ROWS0166
L  CI9                                                                  ROWS0167
L  CL7                                                                  ROWS0168
L  CL8                                                                  ROWS0169
L  CL9                                                                  ROWS0170
L  CM7                                                                  ROWS0171
L  CM8                                                                  ROWS0172
L  CM9                                                                  ROWS0173
L  CN7                                                                  ROWS0174
L  CN8                                                                  ROWS0175
L  CN9                                                                  ROWS0176
L  CO7                                                                  ROWS0177
L  CO8                                                                  ROWS0178
L  CO9                                                                  ROWS0179
L  CP7                                                                  ROWS0180
```

```
 L  CP8                                                          ROWS0181
 L  CP9                                                          ROWS0182
 L  CQ7                                                          ROWS0183
 L  CQ8                                                          ROWS0184
 L  CQ9                                                          ROWS0185
 L  CR7                                                          ROWS0186
 L  CR8                                                          ROWS0187
 L  CR9                                                          ROWS0188
 L  CS7                                                          ROWS0189
 L  CS8                                                          ROWS0190
 L  CS9                                                          ROWS0191
 L  CV7                                                          ROWS0192
 L  CV8                                                          ROWS0193
 L  CV9                                                          ROWS0194
 L  CW7                                                          ROWS0195
 L  CW8                                                          ROWS0196
 L  CW9                                                          ROWS0197
 L  RD7                                                          ROWS0198
 L  RD8                                                          ROWS0199
 L  RD9                                                          ROWS0200
 L  RE7                                                          ROWS0201
 L  RE8                                                          ROWS0202
 L  RE9                                                          ROWS0203
 L  RF7                                                          ROWS0204
 L  RF8                                                          ROWS0205
 L  RF9                                                          ROWS0206
 L  RG7                                                          ROWS0207
 L  RG8                                                          ROWS0208
 L  RG9                                                          ROWS0209
 L  RI7                                                          ROWS0210
 L  RI8                                                          ROWS0211
 L  RI9                                                          ROWS0212
 L  RL7                                                          ROWS0213
 L  RL8                                                          ROWS0214
 L  RL9                                                          ROWS0215
 L  RM7                                                          ROWS0216
 L  RM8                                                                  ROWS0217
 L  RM9                                                                  ROWS0218
 L  RN7                                                                  ROWS0219
 L  RN8                                                                  ROWS0220
 L  RN9                                                                  ROWS0221
 L  RO7                                                                  ROWS0222
 L  RO8                                                                  ROWS0223
 L  RO9                                                                  ROWS0224
 L  RP7                                                                  ROWS0225
 L  RP8                                                                  ROWS0226
 L  RP9                                                                  ROWS0227
 L  RQ7                                                                  ROWS0228
 L  RQ8                                                                  ROWS0229
 L  RQ9                                                                  ROWS0230
 L  RR7                                                                  ROWS0231
 L  RR8                                                                  ROWS0232
 L  RR9                                                                  ROWS0233
 L  RS7                                                                  ROWS0234
 L  RS8                                                                  ROWS0235
 L  RS9                                                                  ROWS0236
 L  RW7                                                                  ROWS0237
 L  RW8                                                                  ROWS0238
 L  RW9                                                                  ROWS0239
 L  RV7                                                                  ROWS0240
 L  RV8                                                                  ROWS0241
 L  RV9                                                                  ROWS0242
 G  ME7                                                                  ROWS0243
 G  ME8                                                                  ROWS0244
 G  ME9                                                                  ROWS0245
 G  MF7                                                                  ROWS0246
 G  MF8                                                                  ROWS0247
 G  MF9                                                                  ROWS0248
 G  MI7                                                                  ROWS0249
 G  MI8                                                                  ROWS0250
 G  MI9                                                                  ROWS0251
 G  MN7                                                                  ROWS0252
 G  MN8                                                  ROWS0253
 G  MN9                                                  ROWS0254
 G  MU7                                                  ROWS0255
 G  MU8                                                  ROWS0256
 G  MU9                                                  ROWS0257
 G  MP7                                                  ROWS0258
 G  MP8                                                  ROWS0259
 G  MP9                                                  ROWS0260
 G  MR7                                                  ROWS0261
 G  MR8                                                  ROWS0262
 G  MR9                                                  ROWS0263
 G  MV7                                                  ROWS0264
 G  MV8                                                  ROWS0265
 G  MV9                                                  ROWS0266
 G  MW7                                                  ROWS0267
 G  MW8                                                  ROWS0268
 G  MW9                                                  ROWS0269
 L  FE                                                   ROWS0270
 L  FF                                                   ROWS0271
 L  FN                                                   ROWS0272
 L  FU                                                   ROWS0273
 L  FP                                                   ROWS0274
 L  FV                                                   ROWS0275
 L  FW                                                   ROWS0276
```

```
COLUMNS                                                                       CLMN0001
    QCOD7     CD7       1.             CD8       -1.                          CLMN0002
    QCOD8     CD8       1.             CD9       -1.                          CLMN0003
    QCOD9     CD9       1.                                                    CLMN0004
    QCOG7     CG7       1.             CG8       -1.                          CLMN0005
    QCOG8     CG8       1.             CG9       -1.                          CLMN0006
    QCOG9     CG9       1.                                                    CLMN0007
    QCOL7     CL7       1.             CL8       -1.                          CLMN0008
    QCOL8     CL8       1.             CL9       -1.                          CLMN0009
    QCOL9     CL9       1.                                                    CLMN0010
    QCOM7     CM7       1.             CM8       -1.                          CLMN0011
    QCOM8     CM8       1.             CM9       -1.                          CLMN0012
    QCOM9     CM9       1.                                                    CLMN0013
    QCOQ7     CQ7       1.             CQ8       -1.                          CLMN0014
    QCOQ8     CQ8       1.             CQ9       -1.                          CLMN0015
    QCOQ9     CQ9       1.                                                    CLMN0016
    QCOS7     CS7       1.             CS8       -1.                          CLMN0017
    QCOS8     CS8       1.             CS9       -1.                          CLMN0018
    QCOS9     CS9       1.                                                    CLMN0019
    DQD7      DD7       1.             CD7       -1.                          CLMN0020
    DQD8      DD8       1.             CD8       -1.                          CLMN0021
    DQD9      DD9       1.             CD9       -1.                          CLMN0022
    DQE7      ED7       1.             CE7       -1.                          CLMN0023
    DQE7      CE8       -1.            CE9       -1.                          CLMN0024
    DQE8      ED8       1.             CE8       -1.                          CLMN0025
    DQE8      CE9       -1.                                                   CLMN0026
    DQE9      ED9       1.             CE9       -1.                          CLMN0027
    DQF7      FD7       1.             CF7       -1.                          CLMN0028
    DQF7      CF8       -1.            CF9       -1.                          CLMN0029
    DQF8      FD8       1.             CF8       -1.                          CLMN0030
    DQF8      CF9       -1.                                                   CLMN0031
    DQF9      FD9       1.             CF9       -1.                          CLMN0032
    DQG7      GD71      1.             CG7       -1.                          CLMN0033
    DQG8      GD81      1.             CG8       -1.                          CLMN0034
    DQG9      GD91      1.             CG9       -1.                          CLMN0035
    DQI7      ID7       1.             CI7       -1.                          CLMN0036
```

```
DQI7      CI8       -1.             CI9       -1.                           CLMN0037
DQI8      ID8        1.             CI8       -1.                           CLMN0038
DQI8      CI9       -1.                                                     CLMN0039
DQI9      ID9        1.             CI9       -1.                           CLMN0040
DQL7      LD7        1.             CL7       -1.                           CLMN0041
DQL8      LD8        1.             CL8       -1.                           CLMN0042
DQL9      LD9        1.             CL9       -1.                           CLMN0043
DQM7      MD7        1.             CM7       -1.                           CLMN0044
DQM8      MD8        1.             CM8       -1.                           CLMN0045
DQM9      MD9        1.             CM9       -1.                           CLMN0046
DQN7      ND7        1.             CN7       -1.                           CLMN0047
DQN7      CN8       -1.             CN9       -1.                           CLMN0048
DQN8      ND8        1.             CN8       -1.                           CLMN0049
DQN8      CN9       -1.                                                     CLMN0050
DQN9      ND9        1.             CN9       -1.                           CLMN0051
DQO7      OD7        1.             CO7       -1.                           CLMN0052
DQO7      CO8       -1.             CO9       -1.                           CLMN0053
DQO8      OD8        1.             CO8       -1.                           CLMN0054
DQO8      CO9       -1.                                                     CLMN0055
DQO9      OD9        1.             CO9       -1.                           CLMN0056
DQP7      PD7        1.             CP7       -1.                           CLMN0057
DQP7      CP8       -1.             CP9       -1.                           CLMN0058
DQP8      PD8        1.             CP8       -1.                           CLMN0059
DQP8      CP9       -1.                                                     CLMN0060
DQP9      PD9        1.             CP9       -1.                           CLMN0061
DQQ7      QD7        1.             CQ7       -1.                           CLMN0062
DQQ8      QD8        1.             CQ8       -1.                           CLMN0063
DQQ9      QD9        1.             CQ9       -1.                           CLMN0064
DQR7      RD71       1.             CR7       -1.                           CLMN0065
DQR7      CR8       -1.             CR9       -1.                           CLMN0066
DQR8      RD81       1.             CR8       -1.                           CLMN0067
DQR8      CR9       -1.                                                     CLMN0068
DQR9      RD91       1.             CR9       -1.                           CLMN0069
DQS7      SD7        1.             CS7       -1.                           CLMN0070
DQS8      SD8        1.             CS8       -1.                           CLMN0071
DQS9      SD9        1.             CS9       -1.                           CLMN0072
```

```
    DQV7      VD7       1.             CV7       -1.                      CLMN0073
    DQV7      CV8       -1.            CV9       -1.                      CLMN0074
    DQV8      VD8       1.             CV8       -1.                      CLMN0075
    DQV8      CV9       -1.                                               CLMN0076
    DQV9      VD9       1.             CV9       -1.                      CLMN0077
    DQW7      WD7       1.             CW7       -1.                      CLMN0078
    DQW7      CW8       -1.            CW9       -1.                      CLMN0079
    DQW8      WD8       1.             CW8       -1.                      CLMN0080
    DQW8      CW9       -1.                                               CLMN0081
    DQW9      WD9       1.             CW9       -1.                      CLMN0082
    SBG7      COST7     1.00           GB7       1.                       CLMN0083
    SBG7      CG7       1.             RG7       1.                       CLMN0084
    SBG7      DIST      6.                                                CLMN0085
    SBG7      EQ        1.                                                CLMN0086
    SBG8      COST8     1.42           GB8       1.                       CLMN0087
    SBG8      CG8       1.             RG8       1.                       CLMN0088
    SBG8      DIST      6.                                                CLMN0089
    SBG8      EQ        1.                                                CLMN0090
    SBG9      COST9     1.47           GB9       1.                       CLMN0091
    SBG9      CG9       1.             RG9       1.                       CLMN0092
    SBG9      DIST      6.                                                CLMN0093
    SBG9      EQ        1.                                                CLMN0094
    SBI7      COST7     .49            GB7       1.                       CLMN0095
    SBI7      CI7       1.             RI7       1.                       CLMN0096
    SBI7      DIST      1.7                                               CLMN0097
    SBI8      COST8     .69            GB7       1.                       CLMN0098
    SBI8      CI8       1.             RI8       1.                       CLMN0099
    SBI8      DIST      1.7                                               CLMN0100
    SBI9      COST9     .74            GB9       1.                       CLMN0101
    SBI9      CI9       1.             RI9       1.                       CLMN0102
    SBI9      DIST      1.7                                               CLMN0103
    SBN7      COST7     1.75           GB7       1.                       CLMN0104
    SBN7        CN7     1.             RN7       1.                       CLMN0105
    SBN7      DIST      12.                                               CLMN0106
    SBN7      EQ        1.                                                CLMN0107
    SBN8      COST8     2.46           GB8       1.                       CLMN0108
    SBN8        CN8     1.                RN8       1.                                  CLMNO109
    SBN8       DIST     12.                                                             CLMNO110
    SBN8       EQ       1.                                                              CLMNO111
    SBN9       COST9    2.64              GB9       1.                                  CLMNO112
    SBN9       CN9      1.                RN9       1.                                  CLMNO113
    SBN9       DIST     12.                                                             CLMNO114
    SBN9       EQ       1.                                                              CLMNO115
    SBO7       COST7    1.10              GB7       1.                                  CLMNO116
    SBO7       CO7      1.                RO7       1.                                  CLMNO117
    SBO7       DIST     3.75                                                            CLMNO118
    SBO7       EQ       1.                                                              CLMNO119
    SBO8       COST8    1.54              GB8       1.                                  CLMNO120
    SBO8       CO8      1.                RO8       1.                                  CLMNO121
    SBO8       DIST     3.75                                                            CLMNO122
    SBO8       EQ       1.                                                              CLMNO123
    SBO9       COST9    1.64              GB9       1.                                  CLMNO124
    SBO9        CO9     1.                RO7       1.                                  CLMNO125
    SBO9       DIST     3.75                                                            CLMNO126
    SBO9       EQ       1.                                                              CLMNO127
    SBP7       COST7    1.69              GB7       1.                                  CLMNO128
    SBP7       CP7      1.                RP7       1.                                  CLMNO129
    SBP7       DIST     10.                                                             CLMNO130
    SBP7       EQ       1.                                                              CLMNO131
    SBP8       COST8    2.35              GB8       1.                                  CLMNO132
    SBP8       CP8      1.                RP8       1.                                  CLMNO133
    SBP8       EQ       1.                                                              CLMNO134
    SBP8       DIST     10.                                                             CLMNO135
    SBP9       COST9    2.50              GB9       1.                                  CLMNO136
    SBP9       CP9      1.                RP9       1.                                  CLMNO137
    SBP9       DIST     10.                                                             CLMNO138
    SBP9       EQ       1.                                                              CLMNO139
    SBQ7       COST7    .92               GB7       1.                                  CLMNO140
    SBQ7       CQ7      1.                RQ7       1.                                  CLMNO141
    SBQ7       DIST     5.5                                                             CLMNO142
    SBQ7       EQ       1.                                                              CLMNO143
    SBQ8       COST8    1.30              GB8       1.                                  CLMNO144
```

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SBQ8      CQ8       1.          RQ8       1.                        CLMNO145
SBQ8      EQ        1.                                              CLMNO146
SBQ8      DIST      5.5                                             CLMNO147
SBQ9      COST9     1.64        GB9       1.                        CLMNO148
SBQ9      CQ9       1.          RQ9       1.                        CLMNO149
SBQ9      DIST      5.5                                             CLMNO150
SBQ9      EQ        1.                                              CLMNO151
SBR7      COST7     .96         GB7       1.                        CLMNO152
SBR7      EQ        1.                                              CLMNO153
SBR7      CR7       1.          RR7       1.                        CLMNO154
SBR7      DIST      3.3                                             CLMNO155
SBR8      EQ        1.                                              CLMNO156
SBR8      COST8     1.34        GB8       1.                        CLMNO157
SBR8      CR8       1.          RR8       1.                        CLMNO158
SBR8      DIST      3.3                                             CLMNO159
SBR9      COST9     1.43        GB9       1.                        CLMNO160
SBR9      EQ        1.                                              CLMNO161
SBR9      CR9       1.          RR9       1.                        CLMNO162
SBR9      DIST      3.3                                             CLMNO163
SBS7      COST7     1.55        GB7       1.                        CLMNO164
SBS7      EQ        1.                                              CLMNO165
SBS7      CS7       1.          RS7       1.                        CLMNO166
SBS7      DIST      9.0                                             CLMNO167
SBS8      COST8     2.14        GB8       1.                        CLMNO168
SBS8      CS8       1.          RS8       1.                        CLMNO169
SBS8      EQ        1.                                              CLMNO170
SBS8      DIST      9.                                              CLMNO171
SBS9      COST9     2.27        GB9       1.                        CLMNO172
SBS9      CS9       1.          RS9       1.                        CLMNO173
SBS9      DIST      9.                                              CLMNO174
SBS9      EQ        1.                                              CLMNO175
SCF7      COST7     1.          GC7       1.                        CLMNO176
SCF7      EQ        1.                                              CLMNO177
SCF7      CF7       1.          RF7       1.                        CLMNO178
SCF7      DIST      5.                                              CLMNO179
SCF8      COST8     1.38        GC8       1.                        CLMNO180
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SCF8      EQ        1.                                                    CLMN0181
SCF8      CF8       1.          RF8       1.                              CLMN0182
SCF8      DIST      5.                                                    CLMN0183
SCF9      COST9     1.44        GC9       1.                              CLMN0184
SCF9      CF9       1.          RF9       1.                              CLMN0185
SCF9      DIST      5.                                                    CLMN0186
SCF9      EQ        1.                                                    CLMN0187
SCI7      COST7     1.32        GC7       1.                              CLMN0188
SCI7      EQ        1.                                                    CLMN0189
SCI7      CI7       1.          RI7       1.                              CLMN0190
SCI7      DIST      4.4                                                   CLMN0191
SCI8      EQ        1.                                                    CLMN0192
SCI8      COST8     1.85        GC8       1.                              CLMN0193
SCI8      CI8       1.          RI8       1.                              CLMN0194
SCI8      DIST      4.4                                                   CLMN0195
SCI9      COST9     1.97        GC9       1.                              CLMN0196
SCI9      CI9       1.          RI9       1.                              CLMN0197
SCI9      DIST      4.4                                                   CLMN0198
SCI9      EQ        1.                                                    CLMN0199
SCN7      COST7     1.58        GC7       1.                              CLMN0200
SCN7      CN7       1.          RN7       1.                              CLMN0201
SCN7      DIST      8.                                                    CLMN0202
SCN7      EQ        1.                                                    CLMN0203
SCN8      COST8     2.20        GC8       1.                              CLMN0204
SCN8      CN8       1.          RN8       1.                              CLMN0205
SCN8      DIST      8.                                                    CLMN0206
SCN8      EQ        1.                                                    CLMN0207
SCN9      COST9     2.33        GC9       1.                              CLMN0208
SCN9      EQ        1.                                                    CLMN0209
SCN9      CN9       1.          RN9       1.                              CLMN0210
SCN9      DIST      8.                                                    CLMN0211
SCO7      COST7     1.62        GC7       1.                              CLMN0212
SCO7      CO7       1.          RO7       1.                              CLMN0213
SCO7      DIST      6.                                                    CLMN0214
SCO7      EQ        1.                                                    CLMN0215
SCO8      COST8     2.27        GC8       1.                              CLMN0216
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    SCO8      CO8       1.             RO8       1.                              CLMN0217
    SCO8      EQ        1.                                                       CLMN0218
    SCO8      DIST      6.                                                       CLMN0219
    SCO9      COST9     2.41           GC9       1.                              CLMN0220
    SCO9      EQ        1.                                                       CLMN0221
    SCO9      CO9       1.             RO9       1.                              CLMN0222
    SCO9      DIST      6.                                                       CLMN0223
    SCR7      COST7     .61            GC7       1.                              CLMN0224
    SCR7      CR7       1.             RR7       1.                              CLMN0225
    SCR7      DIST      2.1                                                      CLMN0226
    SCR8      COST8     .85            GC8       1.                              CLMN0227
    SCR8      CR8       1.             RR8       1.                              CLMN0228
    SCR8      DIST      2.1                                                      CLMN0229
    SCR9      COST9     .90            GC9       1.                              CLMN0230
    SCR9      CR9       1.             RR9       1.                              CLMN0231
    SCR9      DIST      2.1                                                      CLMN0232
    SCS7      COST7     1.58           GC7       1.                              CLMN0233
    SCS7      EQ        1.                                                       CLMN0234
    SCS7      CS7       1.             RS7       1.                              CLMN0235
    SCS7      DIST      8.                                                       CLMN0236
    SCS8      EQ        1.                                                       CLMN0237
    SCS8      COST8     2.20           GC8       1.                              CLMN0238
    SCS8      CS8       1.             RS8       1.                              CLMN0239
    SCS8      DIST      8.                                                       CLMN0240
    SCS9      COST9     2.33           GC9       1.                              CLMN0241
    SCS9      EQ        1.                                                       CLMN0242
    SCS9      CS9       1.             RS9       1.                              CLMN0243
    SCS9      DIST      8.                                                       CLMN0244
    SCV7      COST7     .89            GC7       1.                              CLMN0245
    SCV7      CV7       1.             RV7       1.                              CLMN0246
    SCV7      EQ        1.                                                       CLMN0247
    SCV7      DIST      3.                                                       CLMN0248
    SCV8      COST8     1.22           GC8       1.                              CLMN0249
    SCV8      CV8       1.             RV8       1.                              CLMN0250
    SCV8      EQ        1.                                                       CLMN0251
    SCV8      DIST      3.                                                       CLMN0252
    SCV9      COST9     1.32           GC9       1.                      CLMN0253
    SCV9      CV9       1.             RV9       1.                      CLMN0254
    SCV9      DIST      3.                                               CLMN0255
    SCV9      EQ        1.                                               CLMN0256
    SDG7      COST7     1.01           GD7       1.                      CLMN0257
    SDG7      CG7       1.             RG7       1.                      CLMN0258
    SDG7      EQ        1.                                               CLMN0259
    SDG7      DIST      6.                                               CLMN0260
    SDG8      COST8     1.42           GD8       1.                      CLMN0261
    SDG8      EQ        1.                                               CLMN0262
    SDG8      CG8       1.             RG8       1.                      CLMN0263
    SDG8      DIST      6.                                               CLMN0264
    SDG9      COST9     1.52           GD9       1.                      CLMN0265
    SDG9      CG9       1.             RG9       1.                      CLMN0266
    SDG9      EQ        1.                                               CLMN0267
    SDG9      DIST      9.                                               CLMN0268
    SDI7      COST7     1.17           GD7       1.                      CLMN0269
    SDI7      CI7       1.             RI7       1.                      CLMN0270
    SDI7      DIST      7.                                               CLMN0271
    SDI7      EQ        1.                                               CLMN0272
    SDI8      COST8     1.65           GD8       1.                      CLMN0273
    SDI8      CI8       1.             RI8       1.                      CLMN0274
    SDI8      DIST      7.                                               CLMN0275
    SDI8      EQ        1.                                               CLMN0276
    SDI9      COST9     1.75           GD9       1.                      CLMN0277
    SDI9      CI9       1.             RI9       1.                      CLMN0278
    SDI9      EQ        1.                                               CLMN0279
    SDI9      DIST      7.                                               CLMN0280
    SDN7      COST7     1.65           GD7       1.                      CLMN0281
    SDN7      CN7       1.             RN7       1.                      CLMN0282
    SDN7      EQ        1.                                               CLMN0283
    SDN7      DIST      8.5                                              CLMN0284
    SDN8      COST8     2.32           GD8       1.                      CLMN0285
    SDN8      EQ        1.                                               CLMN0286
    SDN8      CN8       1.             RN8       1.                      CLMN0287
    SDN8      DIST      8.5                                              CLMN0288
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SDN9      COST9     2.48       GD9       1.                     CLMN0289
SDN9      EQ        1.                                          CLMN0290
SDN9      CN9       1.         RN9       1.                     CLMN0291
SDN9      DIST      8.5                                         CLMN0292
SDO7      COST7     .89        GD7       1.                     CLMN0293
SDO7      CO7       1.         RO7       1.                     CLMN0294
SDO7      DIST      4.5                                         CLMN0295
SDO7      EQ        1.                                          CLMN0296
SDO8      COST8     1.23       GD8       1.                     CLMN0297
SDO8      EQ        1.                                          CLMN0298
SDO8      CO8       1.         RO8       1.                     CLMN0299
SDO8      DIST      4.5                                         CLMN0300
SDO9      COST9     1.32       GD9       1.                     CLMN0301
SDO9      EQ        1.                                          CLMN0302
SDO9      CO9       1.         RO9       1.                     CLMN0303
SDO9      DIST      4.5                                         CLMN0304
SDP7      COST7     .71        GD7       1.                     CLMN0305
SDP7      CP7       1.         RP7       1.                     CLMN0306
SDP7      DIST      3.                                          CLMN0307
SDP8      COST8     .98        GD8       1.                     CLMN0308
SDP8      CP8       1.         RP8       1.                     CLMN0309
SDP8      DIST      3.                                          CLMN0310
SDP9      COST9     1.06       GD9       1.                     CLMN0311
SDP9      CP9       1.         RP9       1.                     CLMN0312
SDP9      DIST      3.                                          CLMN0313
SDQ7      COST7     1.26       GD7       1.                     CLMN0314
SDQ7      CQ7       1.         RQ7       1.                     CLMN0315
SDQ7      DIST      7.5                                         CLMN0316
SDQ7      EQ        1.                                          CLMN0317
SDQ8      EQ        1.                                          CLMN0318
SDQ8      COST8     1.77       GD8       1.                     CLMN0319
SDQ8      CQ8       1.         RQ8       1.                     CLMN0320
SDQ8      DIST      7.5                                         CLMN0321
SDQ9      COST9     1.90       GD9       1.                     CLMN0322
SDQ9      EQ        1.                                          CLMN0323
SDQ9      CQ9       1.         RQ9       1.                     CLMN0324
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SDQ9      DIST      7.5                                CLMNO325
SDW7      EQ        1.                                 CLMNO326
SDW7      COST7     1.44          GD7       1.         CLMNO327
SDW7        CW7     1.            RW7       1.         CLMNO328
SDW7      DIST      8.                                 CLMNO329
SDW8      COST8     2.05          GD8       1.         CLMNO330
SDW8        CW8     1.            RW8       1.         CLMNO331
SDW8      DIST      8.                                 CLMNO332
SDW8      EQ        1.                                 CLMNO333
SDW9      EQ        1.                                 CLMNO334
SDW9      COST9     2.50          GD9       1.         CLMNO335
SDW9        CW9     1.            RW9       1.         CLMNO336
SDW9      DIST      8.                                 CLMNO337
SEF7      COST7     1.75          GE7       1.         CLMNO338
SEF7      CF7       1.            RF7       1.         CLMNO339
SEF7      DIST      9.                                 CLMNO340
SEF7      EQ        1.                                 CLMNO341
SEF8      EQ        1.                                 CLMNO342
SEF8      COST8     2.46          GE8       1.         CLMNO343
SEF8      CF8       1.            RF8       1.         CLMNO344
SEF8      DIST      9.                                 CLMNO345
SEF9      COST9     2.60          GE9       1.         CLMNO346
SEF9      CF9       1.            RF9       1.         CLMNO347
SEF9      EQ        1.                                 CLMNO348
SEF9      DIST      9.                                 CLMNO349
SEI7      COST7     .99           GE7       1.         CLMNO350
SEI7      CI7       1.            RI7       1.         CLMNO351
SEI7      DIST      5.9                                CLMNO352
SEI7      EQ        1.                                 CLMNO353
SEI8      EQ        1.                                 CLMNO354
SEI8      COST8     1.52          GE8       1.         CLMNO355
SEI8      CI8       1.            RI8       1.         CLMNO356
SEI8      DIST      5.9                                CLMNO357
SEI9      COST9     2.60          GE9       1.         CLMNO358
SEI9      EQ        1.                                 CLMNO359
SEI9      CI9       1.            RI9       1.         CLMNO360
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SEI9      DIST      9.                                        CLMN0361
SER7      EQ        1.                                        CLMN0362
SER7      COST7     .99       GE7       1.                    CLMN0363
SER7      CR7       1.        RR7       1.                    CLMN0364
SER7      DIST      3.5                                       CLMN0365
SER8      EQ        1.                                        CLMN0366
SER8      COST8     1.37      GE8       1.                    CLMN0367
SER8      CR8       1.        RR8       1.                    CLMN0368
SER8      DIST      3.5                                       CLMN0369
SER9      COST9     1.47      GE9       1.                    CLMN0370
SER9      CR9       1.        RR9       1.                    CLMN0371
SER9      DIST      3.5                                       CLMN0372
SER9      EQ        1.                                        CLMN0373
SES7      COST7     .90       GE7       1.                    CLMN0374
SES7      CS7       1.        RS7       1.                    CLMN0375
SES7      DIST      3.2                                       CLMN0376
SES7      EQ        1.                                        CLMN0377
SES8      COST8     1.26      GE8       1.                    CLMN0378
SES8      EQ        1.                                        CLMN0379
SES8      CS8       1.        RS8       1.                    CLMN0380
SES8      DIST      3.2                                       CLMN0381
SES9      COST9     1.35      GE9       1.                    CLMN0382
SES9      CS9       1.        RS9       1.                    CLMN0383
SES9      DIST      3.2                                       CLMN0384
SES9      EQ        1.                                        CLMN0385
SFF7      COST7     .89       GF7       1.                    CLMN0386
SFF7      CF7       1.        RF7       1.                    CLMN0387
SFF7      EQ        1.                                        CLMN0388
SFF7      DIST      4.5                                       CLMN0389
SFF8      EQ        1.                                        CLMN0390
SFF8      COST8     1.23      GF8       1.                    CLMN0391
SFF8      CF8       1.        RF8       1.                    CLMN0392
SFF8      DIST      4.5                                       CLMN0393
SFF9      COST9     1.32      GF9       1.                    CLMN0394
SFF9      CF9       1.        RF9       1.                    CLMN0395
SFF9      DIST      4.5                                       CLMN0396
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    SFF9      EQ        1.                                                  CLMN0397
    SFL7      COST7     1.17         GF7       1.                           CLMN0398
    SFL7      CL7       1.           RL7       1.                           CLMN0399
    SFL7      DIST       7.          EQ        1.                           CLMN0400
    SFL8      COST8     1.65         GL8       1.                           CLMN0401
    SFL8      DIST       7.          EQ        1.                           CLMN0402
    SFL8      CL8       1.           RL8       1.                           CLMN0403
    SFL9      COST9     1.75         GL9       1.                           CLMN0404
    SFL9      CL9       1.           RL9       1.                           CLMN0405
    SFL9      DIST       7.          EQ        1.                           CLMN0406
    SFN7      COST7     1.07         GF7       1.                           CLMN0407
    SFN7      EQ        1.                                                  CLMN0408
    SFN7      CN7       1.           RN7       1.                           CLMN0409
    SFN7      DIST      5.5                                                 CLMN0410
    SFN8      COST8     1.51         GF8       1.                           CLMN0411
    SFN8      CN8       1.           RN8       1.                           CLMN0412
    SFN8      DIST      5.5                                                 CLMN0413
    SFN8      EQ        1.                                                  CLMN0414
    SFN9      EQ        1.                                                  CLMN0415
    SFN9      COST9     1.61         GF9       1.                           CLMN0416
    SFN9      CN9       1.           RN9       1.                           CLMN0417
    SFN9      DIST      5.5                                                 CLMN0418
    SFO7      COST7     1.36         GF7       1.                           CLMN0419
    SFO7      EQ        1.                                                  CLMN0420
    SFO7      CO7       1.           RO7       1.                           CLMN0421
    SFO7      DIST      7.                                                  CLMN0422
    SFO8      EQ        1.                                                  CLMN0423
    SFO8      COST8     1.93         GF8       1.                           CLMN0424
    SFO8      CO8       1.           RO8       1.                           CLMN0425
    SFO8      DIST      7.                                                  CLMN0426
    SFO9      COST9     2.02         GF9       1.                           CLMN0427
    SFO9      CO9       1.           RO9       1.                           CLMN0428
    SFO9      EQ        1.                                                  CLMN0429
    SFO9      DIST      7.                                                  CLMN0430
    SFR7      COST7     .99          GF7       1.                           CLMN0431
    SFR7      EQ        1.                                                  CLMN0432
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SFR7      CR7       1.             RR7       1.                                   CLMN0433
SFR7      DIST      6.                                                            CLMN0434
SFR8      COST8     1.52           GF8       1.                                   CLMN0435
SFR8      EQ        1.                                                            CLMN0436
SFR8      CR8       1.             RR8       1.                                   CLMN0437
SFR8      DIST      6.                                                            CLMN0438
SFR9      COST9     1.62           GF9       1.                                   CLMN0439
SFR9      EQ        1.                                                            CLMN0440
SFR9      CR9       1.             RR9       1.                                   CLMN0441
SFR9      DIST      6.                                                            CLMN0442
SFS7      EQ        1.                                                            CLMN0443
SFS7      COST7     2.38           GF7       1.                                   CLMN0444
SFS7      CS7       1.             RS7       1.                                   CLMN0445
SFS7      DIST      12.                                                           CLMN0446
SFS8      COST8     3.30           GF8       1.                                   CLMN0447
SFS8      EQ        1.                                                            CLMN0448
SFS8      CS8       1.             RS8       1.                                   CLMN0449
SFS8      DIST      12.                                                           CLMN0450
SFS9      COST9     3.50           GF9       1.                                   CLMN0451
SFS9      CS9       1.             RS9       1.                                   CLMN0452
SFS9      EQ        1.                                                            CLMN0453
SFS9      DIST      12.                                                           CLMN0454
SFV7      COST7     .74            GF7       1.                                   CLMN0455
SFV7      CV7       1.             RV7       1.                                   CLMN0456
SFV7      DIST      2.5                                                           CLMN0457
SFV8      COST8     1.03           GF8       1.                                   CLMN0458
SFV8      CV8       1.             RV8       1.                                   CLMN0459
SFV8      DIST      2.5                                                           CLMN0460
SFV9      COST9     1.10           GF9       1.                                   CLMN0461
SFV9      CV9       1.             RV9       1.                                   CLMN0462
SFV9      DIST      2.5                                                           CLMN0463
SHG7      EQ        1.                                                            CLMN0464
SHG7      COST7     1.17           GH7       1.                                   CLMN0465
SHG7      CG7       1.             RG7       1.                                   CLMN0466
SHG7      DIST      7.                                                            CLMN0467
SHG8      EQ        1.                                                            CLMN0468
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SHG8      COST8     1.65        GH8       1.                            CLMN0469
SHG8      CG8       1.          RG8       1.                            CLMN0470
SHG8      DIST      7.                                                  CLMN0471
SHG9      COST9     1.65        GH9       1.                            CLMN0472
SHG9      CG9       1.          RG9       1.                            CLMN0473
SHG9      DIST      7.                                                  CLMN0474
SHG9      EQ        1.                                                  CLMN0475
SHM7      COST7     .89         GH7       1.                            CLMN0476
SHM7        CM7     1.          RM7       1.                            CLMN0477
SHM7      DIST      4.5                                                 CLMN0478
SHM8      COST8     1.23        GH8       1.                            CLMN0479
SHM8        CM8     1.          RM8       1.                            CLMN0480
SHM8      DIST      4.                                                  CLMN0481
SHM9      COST9     1.32        GH9       1.                            CLMN0482
SHM9        CM9     1.          RM9       1.                            CLMN0483
SHM9      DIST      4.                                                  CLMN0484
SHP7      COST7     1.36        GH7       1.                            CLMN0485
SHP7      EQ        1.                                                  CLMN0486
SHP7      CP7       1.          RP7       1.                            CLMN0487
SHP7      DIST      8.                                                  CLMN0488
SHP8      EQ        1.                                                  CLMN0489
SHP8      COST8     1.90        GH8       1.                            CLMN0490
SHP8      CP8       1.          RP8       1.                            CLMN0491
SHP8      DIST      8.                                                  CLMN0492
SHP9      EQ        1.                                                  CLMN0493
SHP9      COST9     2.02        GH9       1.                            CLMN0494
SHP9        CP9     1.          RP9       1.                            CLMN0495
SHP9      DIST      8.                                                  CLMN0496
SHQ7      COST7     1.36        GH7       1.                            CLMN0497
SHQ7      CQ7       1.          RQ7       1.                            CLMN0498
SHQ7      EQ        1.                                                  CLMN0499
SHQ7      DIST      8.                                                  CLMN0500
SHQ8      COST8     1.90        GH8       1.                            CLMN0501
SHQ8      EQ        1.                                                  CLMN0502
SHQ8      CQ8       1.          RQ8       1.                            CLMN0503
SHQ8      DIST      8.                                                  CLMN0504
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SHQ9      EQ        1.                                          CLMN0505
SHQ9      COST9     2.02        GH9       1.                    CLMN0506
SHQ9      CQ9       1.          RQ9       1.                    CLMN0507
SHQ9      DIST      8.                                          CLMN0508
SLF7      EQ        1.                                          CLMN0509
SLF7      COST7     .88         GL7       1.                    CLMN0510
SLF7        CF7     1.          RF7       1.                    CLMN0511
SLF7      DIST      4.5                                         CLMN0512
SLF8      COST8     1.23        GL8       1.                    CLMN0513
SLF8        CF8     1.          RF8       1.                    CLMN0514
SLF8      DIST      4.                                          CLMN0515
SLF8      EQ        1.                                          CLMN0516
SLF9      COST9     1.32        GL9       1.                    CLMN0517
SLF9      EQ        1.                                          CLMN0518
SLF9      CF9       1.          RF9       1.                    CLMN0519
SLF9      DIST      4.5                                         CLMN0520
SLL7      COST7     .63         RL7       1.                    CLMN0521
SLL7      GL7       1.          CL7       1.                    CLMN0522
SLL7      DIST      2.1                                         CLMN0523
SLL8      COST8     .88         RL8       1.                    CLMN0524
SLL8      GL8       1.          CL8       1.                    CLMN0525
SLL8      DIST      2.1                                         CLMN0526
SLL9      COST9     .94         RL9       1.                    CLMN0527
SLL9      GL9       1.          CL9       1.                    CLMN0528
SLL9      DIST      2.1                                         CLMN0529
SLN7      COST7     1.44        GL7       1.                    CLMN0530
SLN7      EQ        1.                                          CLMN0531
SLN7      CN7       1.          RN7       1.                    CLMN0532
SLN7      DIST      8.5                                         CLMN0533
SLN8      COST8     2.02        GL8       1.                    CLMN0534
SLN8      CN8       1.          RN8       1.                    CLMN0535
SLN8      EQ        1.                                          CLMN0536
SLN8      DIST      8.5                                         CLMN0537
SLN9      COST9     2.14        GL9       1.                    CLMN0538
SLN9      CN9       1.          RN9       1.                    CLMN0539
SLN9      EQ        1.                                          CLMN0540
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SLN9      DIST      8.5                                                   CLMN0541
SLV7      EQ        1.                                                    CLMN0542
SLV7      COST7     1.66          GL7       1.                            CLMN0543
SLV7      CV7       1.            RV7       1.                            CLMN0544
SLV7      DIST      8.5                                                   CLMN0545
SLV8      EQ        1.                                                    CLMN0546
SLV8      COST8     2.32          GL8       1.                            CLMN0547
SLV8      CV8       1.            RV8       1.                            CLMN0548
SLV8      DIST      8.5                                                   CLMN0549
SLV9      COST9     2.48          GL9       1.                            CLMN0550
SLV9      CV9       1.            RV9       1.                            CLMN0551
SLV9      DIST      8.5                                                   CLMN0552
SLV9      EQ        1.                                                    CLMN0553
SMD7      EQ        1.                                                    CLMN0554
SMD7      COST7     1.55          GM7       1.                            CLMN0555
SMD7        CD7     1.            RD7       1.                            CLMN0556
SMD7      DIST      9.                                                    CLMN0557
SMD8      COST8     2.14          GM8       1.                            CLMN0558
SMD8        CD8     1.            RD8       1.                            CLMN0559
SMD8      DIST      9.                                                    CLMN0560
SMD8      EQ        1.                                                    CLMN0561
SMD9      EQ        1.                                                    CLMN0562
SMD9      COST9     2.27          GM9       1.                            CLMN0563
SMD9        CD9     1.            RD9       1.                            CLMN0564
SMD9      DIST      9.                                                    CLMN0565
SMN7      COST7     1.27          GM7       1.                            CLMN0566
SMN7        CN7     1.            RN7       1.                            CLMN0567
SMN7      EQ        1.                                                    CLMN0568
SMN7      DIST      4.5                                                   CLMN0569
SMN8      COST8     1.80          GM8       1.                            CLMN0570
SMN8        CN8     1.            RN8       1.                            CLMN0571
SMN8      EQ        1.                                                    CLMN0572
SMN8      DIST      4.5                                                   CLMN0573
SMN9      COST9     1.93          GM9       1.                            CLMN0574
SMN9        CN9     1.            RN9       1.                            CLMN0575
SMN9      DIST      4.5                                                   CLMN0576
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SMN9      EQ        1.                                              CLMN0577
SMU7      EQ        1.                                              CLMN0578
SMU7      COST7     1.12          GM7       1.                      CLMN0579
SMU7        CC7     1.            RO7       1.                      CLMN0580
SMU7      DIST      6.5                                             CLMN0581
SMU8      COST8     1.52          GM8       1.                      CLMN0582
SMU8        CO8     1.            RC8       1.                      CLMN0583
SMU8      DIST      6.5                                             CLMN0584
SMU8      EQ        1.                                              CLMN0585
SMU9      EQ        1.                                              CLMN0586
SMU9      COST9     1.63          GM9       1.                      CLMN0587
SMU9        CO9     1.            RC9       1.                      CLMN0588
SMU9      DIST      6.5                                             CLMN0589
SMP7      COST7     1.12          GM7       1.                      CLMN0590
SMP7      EQ        1.                                              CLMN0591
SMP7        CP7     1.            RP7       1.                      CLMN0592
SMP7      DIST      6.5                                             CLMN0593
SMP8      COST8     1.52          GM8       1.                      CLMN0594
SMP8        CP8     1.            RP8       1.                      CLMN0595
SMP8      DIST      6.5                                             CLMN0596
SMP8      EQ        1.                                              CLMN0597
SMP9      EQ        1.                                              CLMN0598
SMP9      COST9     1.63          GM9       1.                      CLMN0599
SMP9        CP9     1.            RP9       1.                      CLMN0600
SMP9      DIST      6.5                                             CLMN0601
SMV7      COST7     1.37          GM7       1.                      CLMN0602
SMV7        CV7     1.            RV7       1.                      CLMN0603
SMV7      DIST      8.                                              CLMN0604
SMV7      EQ        1.                                              CLMN0605
SMV8      EQ        1.                                              CLMN0606
SMV8      COST8     1.52          GM8       1.                      CLMN0607
SMV8        CV8     1.            RV8       1.                      CLMN0608
SMV8      DIST      8.                                              CLMN0609
SMV9      COST9     2.02          GM9       1.                      CLMN0610
SMV9        CV9     1.            RV9       1.                      CLMN0611
SMV9      EQ        1.                                              CLMN0612
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SMV9     DIST     8.                                    CLMN0613
SMW7     COST7    951         GM7       1.              CLMN0614
SMW7       CW7      1.        RW7       1.              CLMN0615
SMW7     DIST     1.8                                   CLMN0616
SMW8     COST8    .72         GM8       1.              CLMN0617
SMW8       CW8      1.        RW8       1.              CLMN0618
SMW8     DIST     1.8                                   CLMN0619
SMW9     COST9    980         GM9       1.              CLMN0620
SMW9       CW9      1.        RW9       1.              CLMN0621
SMW9     DIST     1.8                                   CLMN0622
SNN7     COST7    .63         GN7       1.              CLMN0623
SNN7     CN7      1.          RN7       1.              CLMN0624
SNN7     DIST     2.1                                   CLMN0625
SNN8     COST8    .88         GN8       1.              CLMN0626
SNN8     CN8      1.          RN8       1.              CLMN0627
SNN8     DIST     2.1                                   CLMN0628
SNN9     COST9    .94         GN9       1.              CLMN0629
SNN9     CN9      1.          RN9       1.              CLMN0630
SNN9     DIST     2.1                                   CLMN0631
SNO7     COST7    .84         GN7       1.              CLMN0632
SNO7     EQ       1.                                    CLMN0633
SNO7     CO7      1.          RO7       1.              CLMN0634
SNO7     DIST     2.8                                   CLMN0635
SNO8     COST8    1.18        GN8       1.              CLMN0636
SNO8     CO8      1.          RO8       1.              CLMN0637
SNO8     DIST     2.8                                   CLMN0638
SNO8     EQ       1.                                    CLMN0639
SNO9     EQ       1.                                    CLMN0640
SNO9     COST9    1.25        GN9       1.              CLMN0641
SNO9     CO9      1.          RO9       1.              CLMN0642
SNO9     DIST     2.8                                   CLMN0643
SNV7     COST7    1.05        GN7       1.              CLMN0644
SNV7     EQ       1.                                    CLMN0645
SNV7     CV7      1.          RV7       1.              CLMN0646
SNV7     DIST     3.5                                   CLMN0647
SNV8     COST8    1.47        GN8       1.              CLMN0648
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    SNV8      CV8       1.        RV8       1.                                CLMN0649
    SNV8      DIST      3.5                                                   CLMN0650
    SNV8      EQ        1.                                                    CLMN0651
    SNV9      EQ        1.                                                    CLMN0652
    SNV9      COST9     1.56      GN9       1.                                CLMN0653
    SNV9      CV9       1.        RV9       1.                                CLMN0654
    SNV9      DIST      3.5                                                   CLMN0655
    SNW7      EQ        1.                                                    CLMN0656
    SNW7      COST7     1.00      GN7       1.                                CLMN0657
    SNW7         CW7    1.        RW7       1.                                CLMN0658
    SNW7      DIST      5.                                                    CLMN0659
    SNW8      COST8     1.38      GN8       1.                                CLMN0660
    SNW8         CW8    1.        RW8       1.                                CLMN0661
    SNW8      DIST      5.                                                    CLMN0662
    SNW8      EQ        1.                                                    CLMN0663
    SNW9      EQ        1.                                                    CLMN0664
    SNW9      COST9     1.44      GN9       1.                                CLMN0665
    SNW9         CW9    1.        RW9       1.                                CLMN0666
    SNW9      DIST      5.                                                    CLMN0667
    SPD7      COST7     .83       GP7       1.                                CLMN0668
    SPD7         CD7    1.        RD7       1.                                CLMN0669
    SPD7      DIST      4.5                                                   CLMN0670
    SPD8      COST8     1.17      GP8       1.                                CLMN0671
    SPD8         CD8    1.        RD8       1.                                CLMN0672
    SPD8      DIST      4.5                                                   CLMN0673
    SPD9      COST9     1.26      GP9       1.                                CLMN0674
    SPD9         CD9    1.        RD9       1.                                CLMN0675
    SPD9      DIST      4.5                                                   CLMN0676
    SPG7      COST7     1.46      GP7       1.                                CLMN0677
    SPG7         CG7     1.       RG7       1.                                CLMN0678
    SPG7      DIST      10.                                                   CLMN0679
    SPG7      EQ        1.                                                    CLMN0680
    SPG8      EQ        1.                                                    CLMN0681
    SPG8      COST8     2.06      GP8       1.                                CLMN0682
    SPG8         CG8     1.       RG8       1.                                CLMN0683
    SPG8      DIST      10.                                                   CLMN0684
    SPG9      EQ        1.                                  CLMN0685
    SPG9      COST9     2.20         GP9       1.           CLMN0686
    SPG9      CG9       1.           RG9       1.           CLMN0687
    SPG9      DIST      10.                                 CLMN0688
    SPM7      COST7     2.36         GP7       1.           CLMN0689
    SPM7      CM7       1.           RM7       1.           CLMN0690
    SPM7      DIST      14.                                 CLMN0691
    SPM7      EQ        1.                                  CLMN0692
    SPM8      EQ        1.                                  CLMN0693
    SPM8      COST8     3.30         GP8       1.           CLMN0694
    SPM8      CM8       1.           RM8       1.           CLMN0695
    SPM8      DIST      14.                                 CLMN0696
    SPM9      EQ        1.                                  CLMN0697
    SPM9      COST9     3.50         GP9       1.           CLMN0698
    SPM9      CM9       1.           RM9       1.           CLMN0699
    SPM9      DIST      14.                                 CLMN0700
    SPP7      EQ        1.                                  CLMN0701
    SPP7      COST7     .68          GP7       1.           CLMN0702
    SPP7      CP7       1.           RP7       1.           CLMN0703
    SPP7      DIST      4.5                                 CLMN0704
    SPP8      COST8     .94          GP8       1.           CLMN0705
    SPP8      CP8       1.           RP8       1.           CLMN0706
    SPP8      DIST      4.5                                 CLMN0707
    SPP8      EQ        1.                                  CLMN0708
    SPP9      EQ        1.                                  CLMN0709
    SPP9      COST9     1.02         GP9       1.           CLMN0710
    SPP9      CP9       1.           RP9       1.           CLMN0711
    SPP9      DIST      4.5                                 CLMN0712
    SPQ7      COST7     1.75         GP7       1.           CLMN0713
    SPQ7      CQ7       1.           RQ7       1.           CLMN0714
    SPQ7      DIST      12.                                 CLMN0715
    SPQ7      EQ        1.                                  CLMN0716
    SPQ8      EQ        1.                                  CLMN0717
    SPQ8      COST8     2.46         GP8       1.           CLMN0718
    SPQ8      CQ8       1.           RQ8       1.           CLMN0719
    SPQ8      DIST      12.                                 CLMN0720
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SPQ9      COST9     2.64        GP9       1.                  CLMNO721
SPQ9        CQ9     1.          RQ9       1.                  CLMNO722
SPQ9      DIST      12.                                       CLMNO723
SPQ9      EQ        1.                                        CLMNO724
SQE7      COST7     .77         GQ7       1.                  CLMNO725
SQE7        CE7     1.          RE7       1.                  CLMNO726
SQE7      EQ        1.                                        CLMNO727
SQE7      DIST      4.5                                       CLMNO728
SQE8      COST8     1.07        GQ8       1.                  CLMNO729
SQE8        CE8     1.          RE8       1.                  CLMNO730
SQE8      DIST      4.5                                       CLMNO731
SQE8      EQ        1.                                        CLMNO732
SQE9      COST9     1.13        GQ9       1.                  CLMNO733
SQE9      EQ        1.                                        CLMNO734
SQE9        CE9     1.          RE9       1.                  CLMNO735
SQE9      DIST      4.5                                       CLMNO736
SQG7      COST7     .58         GQ7       1.                  CLMNO737
SQG7      CG7       1.          RG7       1.                  CLMNO738
SQG7      DIST      3.                                        CLMNO739
SQG8      COST8     .82         GQ8       1.                  CLMNO740
SQG8      CG8       1.          RG8       1.                  CLMNO741
SQG8      DIST      3.                                        CLMNO742
SQG9      COST9     .67         GQ9       1.                  CLMNO743
SQG9      CG9       1.          RG9       1.                  CLMNO744
SQG9      DIST      3.                                        CLMNO745
SQI7      EQ        1.                                        CLMNO746
SQI7      COST7     1.12        GQ7       1.                  CLMNO747
SQI7      CI7       1.          RI7       1.                  CLMNO748
SQI7      DIST      6.5                                       CLMNO749
SQI8      COST8     1.52        GQ8       1.                  CLMNO750
SQI8      EQ        1.                                        CLMNO751
SQI8      CI8       1.          RI8       1.                  CLMNO752
SQI8      DIST      6.5                                       CLMNO753
SQI9      EQ        1.                                        CLMNO754
SQI9      COST9     1.63        GQ9       1.                  CLMNO755
SQI9      CI9       1.          RI9       1.                  CLMNO756
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SQI9      DIST      6.5                                   CLMN0757
SQM7      COST7     1.67      GQ7       1.                CLMN0758
SQM7        CM7     1.        RM7       1.                CLMN0759
SQM7      DIST      8.5                                   CLMN0760
SQM7      EQ        1.                                    CLMN0761
SQM8      EQ        1.                                    CLMN0762
SQM8      COST8     2.23      GQ7       1.                CLMN0763
SQM8        CM8     1.        RM8       1.                CLMN0764
SQM8      DIST      8.5                                   CLMN0765
SQM9      COST9     2.50      GQ9       1.                CLMN0766
SQM9        CM9     1.        RM9       1.                CLMN0767
SQM9      DIST      8.5                                   CLMN0768
SQM9      EQ        1.                                    CLMN0769
SQP7      COST7     1.44      GQ7       1.                CLMN0770
SQP7      EQ        1.                                    CLMN0771
SQP7        CP7     1.        RP7       1.                CLMN0772
SQP7      DIST      8.                                    CLMN0773
SQP8      COST8     2.05      GQ8       1.                CLMN0774
SQP8        CP8     1.        RP8       1.                CLMN0775
SQP8      DIST      8.                                    CLMN0776
SQP8      EQ        1.                                    CLMN0777
SQP9      EQ        1.                                    CLMN0778
SQP9      COST9     2.14      GQ9       1.                CLMN0779
SQP9        CP9     1.        RP9       1.                CLMN0780
SQP9      DIST      8.                                    CLMN0781
SQQ7      COST7     .58       GQ7       1.                CLMN0782
SQQ7      CQ7       1.        RQ7       1.                CLMN0783
SQQ7      DIST      3.                                    CLMN0784
SQQ8      COST8     .82       GQ8       1.                CLMN0785
SQQ8      CQ8       1.        RQ8       1.                CLMN0786
SQQ8      DIST      3.                                    CLMN0787
SQQ9      COST9     .87       GQ9       1.                CLMN0788
SQQ9      CQ9       1.        RQ9       1.                CLMN0789
SQQ9      DIST      3.                                    CLMN0790
SRF7      COST7     .73       GR7       1.                CLMN0791
SRF7        CF7     1.        RF7       1.                CLMN0792
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SRF7      DIST      2.5                                      CLMN0793
SRF8      COST8     1.02      GR8       1.                   CLMN0794
SRF8        CF8     1.        RF8       1.                   CLMN0795
SRF8      DIST      2.5                                      CLMN0796
SRF9      COST9     1.07      GR9       1.                   CLMN0797
SRF9        CF9     1.        RF9       1.                   CLMN0798
SRF9      DIST      2.5                                      CLMN0799
SRL7      COST7     1.50      GR7       1.                   CLMN0800
SRL7        CL7     1.        RL7       1.                   CLMN0801
SRL7      DIST      7.                                       CLMN0802
SRL7      EQ        1.                                       CLMN0803
SRL8      COST8     1.90      GR8       1.                   CLMN0804
SRL8        CL8     1.        RL8       1.                   CLMN0805
SRL8      DIST      7.                                       CLMN0806
SRL8      EQ        1.                                       CLMN0807
SRL9      COST9     2.02      GR9       1.                   CLMN0808
SRL9        CL9     1.        RL9       1.                   CLMN0809
SRL9      DIST      7.                                       CLMN0810
SRL9      EQ        1.                                       CLMN0811
SRR       COST7     1.36      GR7       1.                   CLMN0812
SRR7        CR7     1.        RR7       1.                   CLMN0813
SRR7      DIST      7.                                       CLMN0814
SRR7      EQ        1.                                       CLMN0815
SRR8      EQ        1.                                       CLMN0816
SRR8      COST8     1.90      GR8       1.                   CLMN0817
SRR8        CR8     1.        RR8       1.                   CLMN0818
SRR8      DIST      7.                                       CLMN0819
SRR9      COST9     2.02      GR9       1.                   CLMN0820
SRR9        CR9     1.        RR9       1.                   CLMN0821
SRR9      DIST      7.                                       CLMN0822
SRR9      EQ        1.                                       CLMN0823
SRS7      COST7     1.52      GR7       1.                   CLMN0824
SRS7        CS7     1.        RS7       1.                   CLMN0825
SRS7      DIST      9.                                       CLMN0826
SRS7      EQ        1.                                       CLMN0827
SRS8      EQ        1.                                       CLMN0828
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SRS8      COST8     2.12           GR8       1.                              CLMN0829
SRS8        CS8     1.             RS8       1.                              CLMN0830
SRS8      DIST      9.                                                       CLMN0831
SRS9      COST9     2.26           GR9       1.                              CLMN0832
SRS9        CS9     1.             RS9       1.                              CLMN0833
SRS9      DIST      9.                                                       CLMN0834
SRS9      EQ        1.                                                       CLMN0835
SRV7      COST7     .940           GR7       1.                              CLMN0836
SRV7      EQ        1.                                                       CLMN0837
SRV7        CV7     1.             RV7       1.                              CLMN0838
SRV7      DIST      6.                                                       CLMN0839
SRV8      COST8     1.52           GR8       1.                              CLMN0840
SRV8        CV8     1.             RV8       1.                              CLMN0841
SRV8      DIST      6.                                                       CLMN0842
SRV8      EQ        1.                                                       CLMN0843
SRV9      EQ        1.                                                       CLMN0844
SRV9      COST9     1.62           GR9       1.                              CLMN0845
SRV9        CV9     1.             RV9       1.                              CLMN0846
SRV9      DIST      6.                                                       CLMN0847
SSF7      COST7     1.00           GS7       1.                              CLMN0848
SSF7      DIST      6.                                                       CLMN0849
SSF7        CF7     1.             RF7       1.                              CLMN0850
SSF7      EQ        1.                                                       CLMN0851
SSF8      EQ        1.                                                       CLMN0852
SSF8      COST8     1.53           GS8       1.                              CLMN0853
SSF8        CF8     1.             RF8       1.                              CLMN0854
SSF8      DIST      6.                                                       CLMN0855
SSF9      COST9     1.65           GS9       1.                              CLMN0856
SSF9        CF9     1.             RF9       1.                              CLMN0857
SSF9      EQ        1.                                                       CLMN0858
SSF9      DIST      6.                                                       CLMN0859
SSS7      COST7     1.19           GS7       1.                              CLMN0860
SSS7        CS7     1.             RS7       1.                              CLMN0861
SSS7      DIST      6.                                                       CLMN0862
SSS7      EQ        1.                                                       CLMN0863
SSS8      COST8     1.66           GS8       1.                              CLMN0864
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SSS8      CS8     1.          RS8       1.                        CLMN0865
SSS8      DIST    6.                                              CLMN0866
SSS8      EQ      1.                                              CLMN0867
SSS9      EQ      1.                                              CLMN0868
SSS9      COST9   1.76        GS9       1.                        CLMN0869
SSS9      CS9     1.          RS9       1.                        CLMN0870
SSS9      DIST    6.                                              CLMN0871
STF7      COST7   1.17        GT7       1.                        CLMN0872
STF7      CF7     1.          RF7       1.                        CLMN0873
STF7      DIST    7.          RF9       1.                        CLMN0874
STF7      EQ      1.                                              CLMN0875
STF8      EQ      1.                                              CLMN0876
STF8      COST8   1.65        GT8       1.                        CLMN0877
STF8      CF8     1.          RF8       1.                        CLMN0878
STF8      DIST    7.          RF9       1.                        CLMN0879
STF9      EQ      1.                                              CLMN0880
STF9      COST9   1.75        GT9       1.                        CLMN0881
STF9      CF9     1.          RF9       1.                        CLMN0882
STF9      DIST    7.                                              CLMN0883
STL7      COST7   1.26        GT7       1.                        CLMN0884
STL7      CL7     1.          RL7       1.                        CLMN0885
STL7      DIST    7.5                                             CLMN0886
STL7      EQ      1.                                              CLMN0887
STL8      COST8   1.77        GT8       1.                        CLMN0888
STL8      DIST    7.5                                             CLMN0889
STL8      CL8     1.          RL8       1.                        CLMN0890
STL8      EQ      1.                                              CLMN0891
STL9      COST9   1.90        GT9       1.                        CLMN0892
STL9      CL9     1.          RL9       1.                        CLMN0893
STL9      EQ      1.                                              CLMN0894
STL9      DIST    7.5                                             CLMN0895
STN7      COST7   .61         GT7       1.                        CLMN0896
STN7      CN7     1.          RN7       1.                        CLMN0897
STN7      DIST    2.                                              CLMN0898
STN7      EQ      1.                                              CLMN0899
STN8      EQ      1.                                              CLMN0900
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STN8     COST8     .85       GT8       1.                         CLMN0901
STN8        CN8    1.        RN8       1.                         CLMN0902
STN8     DIST      2.                                             CLMN0903
STN9     COST9     .90       GT9       1.                         CLMN0904
STN9        CN9    1.        RN9       1.                         CLMN0905
STN9     EQ        1.                                             CLMN0906
STN9     DIST      2.                                             CLMN0907
STV7     COST7     .84       GT7       1.                         CLMN0908
STV7        CV7    1.        RV7       1.                         CLMN0909
STV7     DIST      4.5                                            CLMN0910
STV7     EQ        1.                                             CLMN0911
STV8     EQ        1.                                             CLMN0912
STV8     COST8     1.23      GT8       1.                         CLMN0913
STV8        CV8    1.        RV8       1.                         CLMN0914
STV8     DIST      4.5                                            CLMN0915
STV9     COST9     1.32      GT9       1.                         CLMN0916
STV9        CV9    1.        RV9       1.                         CLMN0917
STV9     DIST      4.5                                            CLMN0918
STV9     EQ        1.                                             CLMN0919
STW7     COST7     1.44      GT7       1.                         CLMN0920
STW7        CW7    1.        RW7       1.                         CLMN0921
STW7     DIST      8.                                             CLMN0922
STW7     EQ        1.                                             CLMN0923
STW8     EQ        1.                                             CLMN0924
STW8     COST8     2.05      GT8       1.                         CLMN0925
STW8        CW8    1.        RW8       1.                         CLMN0926
STW8     DIST      8.                                             CLMN0927
STW9     COST9     2.14      GT9       1.                         CLMN0928
STW9        CW9    1.        RW9       1.                         CLMN0929
STW9     DIST      8.                                             CLMN0930
STW9     EQ        1.                                             CLMN0931
SWI7     COST7     .85       GW7       1.                         CLMN0932
SWI7     CI7       1.        RI7       1.                         CLMN0933
SWI7     DIST      5.                                             CLMN0934
SWI7     EQ        1.                                             CLMN0935
SWI8     EQ        1.                                             CLMN0936
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    SWI8      COST8     1.18           GW8        1.                                CLMN0937
    SWI8      CI8       1.             RI8        1.                                CLMN0938
    SWI8      DIST      5.                                                          CLMN0939
    SWI9      COST9     1.25           GW9        1.                                CLMN0940
    SWI9      CI9       1.             RI9        1.                                CLMN0941
    SWI9      DIST      5.                                                          CLMN0942
    SWI9      EQ        1.                                                          CLMN0943
    SWN7      COST7     1.36           GW7        1.                                CLMN0944
    SWN7      CN7       1.             RN7        1.                                CLMN0945
    SWN7      DIST      7.                                                          CLMN0946
    SWN7      EQ        1.                                                          CLMN0947
    SWN8      EQ        1.                                                          CLMN0948
    SWN8      COST8     1.90           GW8        1.                                CLMN0949
    SWN8      CN8       1.             RN8        1.                                CLMN0950
    SWN8      DIST      7.                                                          CLMN0951
    SWN9      COST9     1.25           GW9        1.                                CLMN0952
    SWN9      CN9       1.             RN9        1.                                CLMN0953
    SWN9      EQ        1.                                                          CLMN0954
    SWN9      DIST      7.                                                          CLMN0955
    SWO7      COST7     .73            GW7        1.                                CLMN0956
    SWO7      CO7       1.             RO7        1.                                CLMN0957
    SWO7      DIST      2.5                                                         CLMN0958
    SWO8      COST8     1.02           GW8        1.                                CLMN0959
    SWO8      CO8       1.             RO8        1.                                CLMN0960
    SWO8      DIST      2.5                                                         CLMN0961
    SWO9      COST9     1.10           GW9        1.                                CLMN0962
    SWO9      CO9       1.             RO9        1.                                CLMN0963
    SWO9      DIST      2.5                                                         CLMN0964
    SWP7      COST7     1.56           GW7        1.                                CLMN0965
    SWP7      CP7       1.             RP7        1.                                CLMN0966
    SWP7      DIST      8.5                                                         CLMN0967
    SWP7      EQ        1.                                                          CLMN0968
    SWP8      EQ        1.                                                          CLMN0969
    SWP8      COST8     2.18           GW8        1.                                CLMN0970
    SWP8      CP8       1.             RP8        1.                                CLMN0971
    SWP8      DIST      8.5                                                         CLMN0972
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SWP9      COST9     2.33          GW9      1.                      CLMN0973
SWP9      CP9       1.            RP9      1.                      CLMN0974
SWP9      DIST      8.5                                            CLMN0975
SWP9      EQ        1.                                             CLMN0976
SWR7      COST7     .89           GW7      1.                      CLMN0977
SWR7      CR7       1.            RR7      1.                      CLMN0978
SWR7      DIST      4.5                                            CLMN0979
SWR7      EQ        1.                                             CLMN0980
SWR8      EQ        1.                                             CLMN0981
SWR8      COST8     1.23          GW8      1.                      CLMN0982
SWR8      CR8       1.            RR8      1.                      CLMN0983
SWR8      DIST      4.5                                            CLMN0984
SWR9      COST9     1.32          GW9      1.                      CLMN0985
SWR9      EQ        1.                                             CLMN0986
SWR9      CR9       1.            RR9      1.                      CLMN0987
SWR9      DIST      4.5                                            CLMN0988
SWV7      COST7     1.02          GW7      1.                      CLMN0989
SWV7      CV7       1.            RV7      1.                      CLMN0990
SWV7      DIST      3.5                                            CLMN0991
SWV7      EQ        1.                                             CLMN0992
SWV8      COST8     1.43          GW8      1.                      CLMN0993
SWV8      CV8       1.            RV8      1.                      CLMN0994
SWV8      DIST      3.5                                            CLMN0995
SWV8      EQ        1.                                             CLMN0996
SWV9      EQ        1.                                             CLMN0997
SWV9      COST9     1.50          GW9      1.                      CLMN0998
SWV9      CV9       1.            RV9      1.                      CLMN0999
SWV9      DIST      3.5                                            CLMN1000
SWW7      COST7     1.52          GW7      19                      CLMN1001
SWW7        CW7     1.            RW7      1.                      CLMN1002
SWW7      DIST      9.                                             CLMN1003
SWW7      EQ        1.                                             CLMN1004
SWW8      EQ        1.                                             CLMN1005
SWW8      COST8     2.12          GW8      1.                      CLMN1006
SWW8        CW8     1.            RW8      1.                      CLMN1007
SWW8      DIST      9.                                             CLMN1008
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    SWW9      COST9     2.50                                            CLMN1009
    SWW9        CW9     1.          GW9       1.                        CLMN1010
    SWW9      DIST      9.          RW9       1.                        CLMN1011
    SWW9      EQ        1.                                              CLMN1012
    SYE7      COST7     .67                                             CLMN1013
    SYE7        CE7     1.          GY7       1.                        CLMN1014
    SYE7      DIST      4.          RE7       1.                        CLMN1015
    SYE8      COST8     .94                                             CLMN1016
    SYE8        CE8     1.          GY8       1.                        CLMN1017
    SYE8      DIST      4.          RE8       1.                        CLMN1018
    SYE9      COST9     1.01                                            CLMN1019
    SYE9        CE9     1.          GY9       1.                        CLMN1020
    SYE9      DIST      4           RE9       1.                        CLMN1021
    SYG7        CG7     1.                                              CLMN1022
    SYG7      COST7     1.44        RG7       1.                        CLMN1023
    SYG7      DIST      8.5         GY7       1.                        CLMN1024
    SYG7      EQ        1.                                              CLMN1025
    SYG8      EQ        1.                                              CLMN1026
    SYG8      COST8     2.02                                            CLMN1027
    SYG8        CG8     1.          GY8       1.                        CLMN1028
    SYG8      DIST      8.5         RG8       1.                        CLMN1029
    SYG9      COST9     2.14                                            CLMN1030
    SYG9        CG9     1.          GY9       1.                        CLMN1031
    SYG9      DIST      8.5         RG9       1.                        CLMN1032
    SYM7      EQ        1.                                              CLMN1033
    SYM7      COST7     1.17                                            CLMN1034
    SYM7        CM7     1.          GY7       1.                        CLMN1035
    SYM7      DIST      7.          RM7       1.                        CLMN1036
    SYM7      EQ        1.                                              CLMN1037
    SYM8      COST8     1.65                                            CLMN1038
    SYM8      EQ        1.          GM7       1.                        CLMN1039
    SYM8        CM8     1.                                              CLMN1040
    SYM8      DIST      7.          RM8       1.                        CLMN1041
    SYM9      COST9     1.75                                            CLMN1042
    SYM9        CM9     1.          GY9       1.                        CLMN1043
    SYM9      EQ        1.          RM9       1.                        CLMN1044
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SYM9      DIST      7.                                         CLMN1045
SYQ7      COST7     1.01          GY7       1.                 CLMN1046
SYQ7        CQ7     1.            RQ7       1.                 CLMN1047
SYQ7      DIST      6.                                         CLMN1048
SYQ7      EQ        1.                                         CLMN1049
SYQ8      EQ        1.                                         CLMN1050
SYQ8      COST8     1.42          GY8       1.                 CLMN1051
SYQ8        CQ8     1.            RQ8       1.                 CLMN1052
SYQ8      DIST      6.                                         CLMN1053
SYQ9      COST9     1.53          GY9       1.                 CLMN1054
SYQ9        CQ9     1.            RQ9       1.                 CLMN1055
SYQ9      DIST      6.                                         CLMN1056
SYQ9      EQ        1.                                         CLMN1057
TEE7      COST7     1.60          ME7       1.                 CLMN1058
TEE7      FE        1.                                         CLMN1059
TEE8      COST8     1.70          ME8       1.                 CLMN1060
TEE8      FE        1.                                         CLMN1061
TEE9      COST9     1.80          ME9       1.                 CLMN1062
TEE9      FE        1.                                         CLMN1063
TEQ7      COST7     .104          ME7       1.                 CLMN1064
TEQ7      CQ7       1.            RQ7       1.                 CLMN1065
TEQ7      EQ        1.                                         CLMN1066
TEQ8      COST8     .16           ME8       1.                 CLMN1067
TEQ8      CQ8       1.            RQ8       1.                 CLMN1068
TEQ8      EQ        1.                                         CLMN1069
TEQ9      COST9     .18           ME9       1.                 CLMN1070
TEQ9      CQ9       1.            RQ9       1.                 CLMN1071
TEQ9      EQ        1.                                         CLMN1072
TFF7      COST7     1.50          MF7       1.                 CLMN1073
TFF7      FF        1.                                         CLMN1074
TFF8      COST8     1.70          MF8       1.                 CLMN1075
TFF8      FF        1.                                         CLMN1076
TFF9      COST9     1.80          MF9       1.                 CLMN1077
TFF9      FF        1.                                         CLMN1078
TFL7      COST7     .193          MF7       1.                 CLMN1079
TFL7      CL7       1.            RL7       1.                 CLMN1080
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TFL7      EQ        1.                                  CLMN1081
TFL8      COST8     .269      MF8       1.              CLMN1082
TFL8      CL8       1.        RL8       1.              CLMN1083
TFL8      EQ        1.                                  CLMN1084
TFL9      COST9     .287      MF9       1.              CLMN1085
TFL9      CL9       1.        RL9       1.              CLMN1086
TFL9      EQ        1.                                  CLMN1087
TIQ7      COST7     .193      MI7       1.              CLMN1088
TIQ7      CQ7       1.        RQ7       1.              CLMN1089
TIQ7      EQ        1.                                  CLMN1090
TIQ8      COST8     .269      MI8       1.              CLMN1091
TIQ8      CQ8       1.        RQ8       1.              CLMN1092
TIQ8      EQ        1.                                  CLMN1093
TIQ9      COST9     .287      MI9       1.              CLMN1094
TIQ9      CQ9       1.        RQ9       1.              CLMN1095
TIQ9      EQ        1.                                  CLMN1096
TIM7      COST7     .193      MI7       1.              CLMN1097
TIM7      CM7       1.        RM7       1.              CLMN1098
TIM7      EQ        1.                                  CLMN1099
TIM8      COST8     .269      MI8       1.              CLMN1100
TIM8      CM8       1.        RM8       1.              CLMN1101
TIM8      EQ        1.                                  CLMN1102
TIM9      COST9     .287      MI9       1.              CLMN1103
TIM9      CM9       1.        RM9       1.              CLMN1104
TIM9      EQ        1.                                  CLMN1105
TIS7      COST7     .273      MI7       1.              CLMN1106
TIS7      CS7       1.        RS7       1.              CLMN1107
TIS7      EQ        1.                                  CLMN1108
TIS8      COST8     .380      MI8       1.              CLMN1109
TIS8      CS8       1.        RS8       1.              CLMN1110
TIS8      EQ        1.                                  CLMN1111
TIS9      COST9     .407      MI9       1.              CLMN1112
TIS9      CS9       1.        RS9       1.              CLMN1113
TIS9      EQ        1.                                  CLMN1114
TNN7      COST7     1.50                                CLMN1115
TNN7      FN        1.        MN7       1.              CLMN1116
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TNN8      COST8     1.70           MN8       1.                        CLMN1117
TNN8      FN        1.                                                 CLMN1118
TNN9      COST9     1.80           MN9       1.                        CLMN1119
TNN9      FN        1.                                                 CLMN1120
TNL7      COST7     .285           MN7       1.                        CLMN1121
TNL7      CL7       1.             RL7       1.                        CLMN1122
TNL7      EQ        1.                                                 CLMN1123
TNL8      COST8     .407           MN8       1.                        CLMN1124
TNL8      CL8       1.             RL8       1.                        CLMN1125
TNL8      EQ        1.                                                 CLMN1126
TNL9      COST9     .43            MN9       1.                        CLMN1127
TNL9      CL9       1.             RL9       1.                        CLMN1128
TNL9      EQ        1.                                                 CLMN1129
TOO7      COST7     1.50           MO7       1.                        CLMN1130
TOO7      FO        1.                                                 CLMN1131
TOO8      COST8     1.50           MO8       1.                        CLMN1132
TOO8      FO        1.                                                 CLMN1133
TOO9      COST9     1.80           MO9       1.                        CLMN1134
TOO9      FO        1.                                                 CLMN1135
TOM7      COST7     .10            MO7       1.                        CLMN1136
TOM7      CM7       1.             RM7       1.                        CLMN1137
TOM7      EQ        1.                                                 CLMN1138
TOM8      COST8     .36            MO8       1.                        CLMN1139
TOM8      EQ        1.                                                 CLMN1140
TOM8      CM8       1.             RM8       1.                        CLMN1141
TOM9      COST9     .54            MO9       1.                        CLMN1142
TOM9      CM9       1.             RM9       1.                        CLMN1143
TOM9      EQ        1.                                                 CLMN1144
TPD7      COST7     .200           MP7       1.                        CLMN1145
TPD7      CD7       1.             RD7       1.                        CLMN1146
TPD7      EQ        1.                                                 CLMN1147
TPD8      COST8     .288           MP8       1.                        CLMN1148
TPD8      CD8       1.             RD8       1.                        CLMN1149
TPD8      EQ        1.                                                 CLMN1150
TPD9      COST9     .300           MP9       1.                        CLMN1151
TPD9      CD9       1.             RD9       1.                        CLMN1152
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TPD9      EQ        1.                                          CLMN1153
TPG7      COST7     .193        MP7       1.                    CLMN1154
TPG7      CG7       1.          RG7       1.                    CLMN1155
TPG7      EQ        1.                                          CLMN1156
TPG8      COST8     .269        MP7       1.                    CLMN1157
TPG8      CG8       1.          RG8       1.                    CLMN1158
TPG8      EQ        1.                                          CLMN1159
TPG9      COST9     .287        MP9       1.                    CLMN1160
TPG9      CG9       1.          RG9       1.                    CLMN1161
TPG9      EQ        1.                                          CLMN1162
TPP7      COST7     1.50        MP7       1.                    CLMN1163
TPP7      FP        1.                                          CLMN1164
TPP8      COST8     1.60        MP8       1.                    CLMN1165
TPP8      FP        1.                                          CLMN1166
TPP9      COST9     1.80        MP9       1.                    CLMN1167
TPP9      FP        1.                                          CLMN1168
TRS7      COST7     .25         MR7       1.                    CLMN1169
TRS7      CS7       1.          RS7       1.                    CLMN1170
TRS7      EQ        1.                                          CLMN1171
TRS8      COST8     .36         MR8       1.                    CLMN1172
TRS8      CS8       1.          RS8       1.                    CLMN1173
TRS8      EQ        1.                                          CLMN1174
TRS9      COST9     .38         MR9       1.                    CLMN1175
TRS9      CS9       1.          RS9       1.                    CLMN1176
TRS9      EQ        1.                                          CLMN1177
TRL7      COST7     .35         MR7       1.                    CLMN1178
TRL7      CL7       1.          RL7       1.                    CLMN1179
TRL7      EQ        1.                                          CLMN1180
TRL8      COST8     .49         MR8       1.                    CLMN1181
TRL8      CL8       1.          RL8       1.                    CLMN1182
TRL8      EQ        1.                                          CLMN1183
TRL9      COST9     .53         MR9       1.                    CLMN1184
TRL9      CL9       1.          RL9       1.                    CLMN1185
TRL9      EQ        1.                                          CLMN1186
TVV7      COST7     1.50        MV7       1.                    CLMN1187
TVV7      FV        1.                                          CLMN1188
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    TVV8      COST8     1.60           MV8       1.                       CLMN1189
    TVV8      FV        1.                                                CLMN1190
    TVV9      COST9     1.80           MV9       1.                       CLMN1191
    TVV9      FV        1.                                                CLMN1192
    TVL7      COST7     .286           MV7       1.                       CLMN1193
    TVL7      CL7       1.             RL7       1.                       CLMN1194
    TVL7      EQ        1.                                                CLMN1195
    TVL8      COST8     .407           MV8       1.                       CLMN1196
    TVL8      CL8       1.             RL8       1.                       CLMN1197
    TVL8      EQ        1.                                                CLMN1198
    TVL9      COST9     .43            MV9       1.                       CLMN1199
    TVL9      CL9       1.             RL9       1.                       CLMN1200
    TVL9      EQ        1.                                                CLMN1201
    TWW7      COST7     1.50           MW7       1.                       CLMN1202
    TWW7      FW        1.                                                CLMN1203
    TWW8      COST8     1.60           MW8       1.                       CLMN1204
    TWW8      FW        1.                                                CLMN1205
    TWW9      COST9     1.80           MW9       1.                       CLMN1206
    TWW9      FW        1.                                                CLMN1207
    PRD7      XD7       1.             RD7       -1.                      CLMN1208
    PRD8      XD8       1.             RD8       -1.                      CLMN1209
    PRD9      XD9       1.             RD9       -1.                      CLMN1210
    PRE7      XE7       1.             RE7       -1.                      CLMN1211
    PRE7      ME7       -.2                                               CLMN1212
    PRE8      XE8       1.             RE8       -1.                      CLMN1213
    PRE8      ME8       -.2                                               CLMN1214
    PRE9      XE9       1.             RE9       -1.                      CLMN1215
    PRE9      ME9       -.2                                               CLMN1216
    PRF7      XF7       1.             RF7       -1.                      CLMN1217
    PRF7      MF7       -.2                                               CLMN1218
    PRF8      XF8       1.             RF8       -1.                      CLMN1219
    PRF8      MF8       -.2                                               CLMN1220
    PRF9      XF9       1.             RF9       -1.                      CLMN1221
    PRF9      MF9       -.2                                               CLMN1222
    PRG7      XG7       1.             RG7       -1.                      CLMN1223
    PRG8      XG8       1.             RG8       -1.                      CLMN1224
    PRG9      XG9       1.             RG9       -1.                     CLMN1225
    PRI7      XI7       1.             RI7       -1.                     CLMN1226
    PRI7      MI7       -.2                                              CLMN1227
    PRI8      XI8       1.             RI8       -1.                     CLMN1228
    PRI8      MI8       -.2                                              CLMN1229
    PRI9      XI9       1.             RI9       -1.                     CLMN1230
    PRI9      MI9       -.2                                              CLMN1231
    PRL7      XL7       1.             RL7       -1.                     CLMN1232
    PRL8      XL8       1.             RL8       -1.                     CLMN1233
    PRL9      XL9       1.             RL9       -1.                     CLMN1234
    PRM7      XM7       1.             RM7       -1.                     CLMN1235
    PRM8      XM8       1.             RM8       -1.                     CLMN1236
    PRM9      XM9       1.             RM9       -1.                     CLMN1237
    PRN7      XN7       1.             RN7       -1.                     CLMN1238
    PRN7      MN7       -.2                                              CLMN1239
    PRN8      XN8       1.             RN8       -1.                     CLMN1240
    PRN8      MN8       -.2                                              CLMN1241
    PRN9      XN9       1.             RN9       -1.                     CLMN1242
    PRN9      MN9       -.2                                              CLMN1243
    PRO7      XO7       1.             RO7       -1.                     CLMN1244
    PRO7      MO7       -.2                                              CLMN1245
    PRO8      XO8       1.             RO8       -1.                     CLMN1246
    PRO8      MO8       -.2                                              CLMN1247
    PRO9      XO9       1.             RO9       -1.                     CLMN1248
    PRO9      MO9       -.2                                              CLMN1249
    PRP7      XP7       1.             RP7       -1.                     CLMN1250
    PRP7      MP7       -.2                                              CLMN1251
    PRP8      XP8       1.             RP8       -1.                     CLMN1252
    PRP8      MP8       -.2                                              CLMN1253
    PRP9      XP9       1.             RP9       -1.                     CLMN1254
    PRP9      MP9       -.2                                              CLMN1255
    PRQ7      XQ7       1.             RQ7       -1.                     CLMN1256
    PRQ8      XQ8       1.             RQ8       -1.                     CLMN1257
    PRQ9      XQ9       1.             RQ9       -1.                     CLMN1258
    PRR7      XR7       1.             RR7       -1.                     CLMN1259
    PRR7      MR7       -1.                                              CLMN1260
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PRR8      XR8       1.            RR8       -1.                 CLMN1261
PRR8      MR8       -1.                                         CLMN1262
PRR9      XR9       1.            RR9       -1.                 CLMN1263
PRR9      MR9       -1.                                         CLMN1264
PRS7      XS7       1.            RS7       -1.                 CLMN1265
PRS8      XS8       1.            RS8       -1.                 CLMN1266
PRS9      XS9       1.            RS9       -1.                 CLMN1267
PRV7      XV7       1.            RV7       -1.                 CLMN1268
PRV7      MV7       -.2                                         CLMN1269
PRV8      XV8       1.            RV8       -1.                 CLMN1270
PRV8      MV8       -.2                                         CLMN1271
PRV9      XV9       1.            RV9       -1.                 CLMN1272
PRV9      MV9       -.2                                         CLMN1273
PRW7      XW7       1.            RW7       -1.                 CLMN1274
PRW7      MW7       -.2                                         CLMN1275
PRW8      XW8       1.            RW8       -1.                 CLMN1276
PRW8      MW8       -.2                                         CLMN1277
PRW9      XW9       1.            RW9       -1.                 CLMN1278
PRW9      MW9       -.2                                         CLMN1279
Y7        COST7     -1.           NPV       .723                CLMN1280
Y7        NPV4      .844          NPV12     .632                CLMN1281
Y8        COST8     -1.           NPV       .334                CLMN1282
Y8        NPV4      .570          NPV12     .202                CLMN1283
Y9        COST9     -1.           NPV       .155                CLMN1284
Y9        NPV4      .385          NPV12     .066                CLMN1285
Y71       COST71    -1.           NPV       1.                  CLMN1286
Y71       NPV4      1.            NPV12     1.                  CLMN1287
Y81       COST81    -1.           NPV       .462                CLMN1288
Y81       NPV4      .675          NPV12     .321                CLMN1289
Y91       COST91    -1.           NPV       .215                CLMN1290
Y91       NPV4      .465          NPV12     .103                CLMN1291
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    SEPCTWD   'MARKER'                 'SEPORG'                          SEPV0001
    DD7A      COST71      4.23         DD7         -1.                   SEPV0002
    DD7B      COST71      .17          DD7         -1.                   SEPV0003
    DD7C      COST71      .06          DD7         -1.                   SEPV0004
    DD7D      COST71      .17          DD7         -1.                   SEPV0005
    SEPCTWI   'MARKER'                 'SEPORG'                          SEPV0006
    DD8A      COST81      4.23         DD8         -1.                   SEPV0007
    DD8B      COST81      .17          DD8         -1.                   SEPV0008
    DD8C      COST81      .06          DD8         -1.                   SEPV0009
    DD8D      COST81      .17          DD8         -1.                   SEPV0010
    SEPCTWX   'MARKER'                 'SEPORG'                          SEPV0011
    DD9A      COST91      4.23         DD9         -1.                   SEPV0012
    DD9B      COST91      .17          DD9         -1.                   SEPV0013
    DD9C      COST91      .06          DD9         -1.                   SEPV0014
    DD9D      COST91      .17          DD9         -1.                   SEPV0015
    SEPCTRN   'MARKER'                 'SEPORG'                          SEPV0016
    DE7A      COST71      4.40         ED7         -1.                   SEPV0017
    DE7B      COST71      5.85         ED7         -1.                   SEPV0018
    DE7C      COST71      3.93         ED7         -1.                   SEPV0019
    SEPSXFI   'MARKER'                 'SEPORG'                          SEPV0020
    DE8A      COST81      4.40         ED8         -1.                   SEPV0021
    DE8B      COST81      5.85         ED8         -1.                   SEPV0022
    DE8C      COST81      3.93         ED8         -1.                   SEPV0023
    SEPSXFR   'MARKER'                 'SEPORG'                          SEPV0024
    DE9A      COST91      4.40         ED9         -1.                   SEPV0025
    DE9B      COST91      5.85         ED9         -1.                   SEPV0026
    DE9C      COST91      3.93         ED9         -1.                   SEPV0027
    SEPSXTQ   'MARKER'                 'SEPORG'                          SEPV0028
    DF7A      COST71      4.40         FD7         -1.                   SEPV0029
    DF7B      COST71      5.85         FD7         -1.                   SEPV0030
    DF7C      COST71      3.93         FD7         -1.                   SEPV0031
    SEPSXTW   'MARKER'                 'SEPORG'                          SEPV0032
    DF8A      COST81      4.40         FD8         -1.                   SEPV0033
    DF8B      COST81      5.85         FD8         -1.                   SEPV0034
    DF8C      COST81      3.93         FD8         -1.                   SEPV0035
    SEPSXTR   'MARKER'                 'SEPORG'                          SEPV0036
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DF9A      COST91    4.40         FD9       -1.                SEPV0037
DF9B      COST91    5.85         FD9       -1.                SEPV0038
DF9C      COST91    3.93         FD9       -1.                SEPV0039
SEPCTWV   'MARKER'               'SEPORG'                     SEPV0040
DG7A      COST71    4.23         GD71      -1.                SEPV0041
DG7B      COST71     .17         GD71      -1.                SEPV0042
DG7C      COST71     .06         GD71      -1.                SEPV0043
DG7D      COST71     .17         GD71      -1.                SEPV0044
SEPCTWE   'MARKER'               'SEPORG'                     SEPV0045
DG8A      COST81    4.23         GD81      -1.                SEPV0046
DG8B      COST81     .17         GD81      -1.                SEPV0047
DG8C      COST81     .06         GD81      -1.                SEPV0048
DG8D      COST81     .17         GD81      -1.                SEPV0049
SEPCTWN   'MARKER'               'SEPORG'                     SEPV0050
DG9A      COST91    4.23         GD91      -1.                SEPV0051
DG9B      COST91     .17         GD91      -1.                SEPV0052
DG9C      COST91     .06         GD91      -1.                SEPV0053
DG9D      COST81     .17         GD91      -1.                SEPV0054
SEPSXTW   'MARKER'               'SEPORG'                     SEPV0055
DI7A      COST71    4.40         ID7       -1.                SEPV0056
DI7B      COST71    5.85         ID7       -1.                SEPV0057
DI7C      COST71    3.93         ID7       -1.                SEPV0058
SEPSXON   'MARKER'               'SEPORG'                     SEPV0059
DI8A      COST81    4.40         ID8       -1.                SEPV0060
DI8B      COST81    5.85         ID8       -1.                SEPV0061
DI8C      COST81    3.93         ID8       -1.                SEPV0062
SEPSXTY   'MARKER'               'SEPORG'                     SEPV0063
DI9A      COST91    4.40         ID9       -1.                SEPV0064
DI9B      COST91    5.85         ID9       -1.                SEPV0065
DI9C      COST91    3.93         ID9       -1.                SEPV0066
SEPCTRY   'MARKER'               'SEPORG'                     SEPV0067
DL7A      COST71    4.23         LD7       -1.                SEPV0068
DL7B      COST71     .17         LD7       -1.                SEPV0069
DL7C      COST71     .06         LD7       -1.                SEPV0070
DL7D      COST71     .17         LD7       -1.                SEPV0071
SEPCTRU   'MARKER'               'SEPORG'                     SEPV0072
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    DL8A      COST81    4.23           LD8       -1.                                  SEPV0073
    DL8B      COST81    .17            LD8       -1.                                  SEPV0074
    DL8C      COST81    .06            LD8       -1.                                  SEPV0075
    DL8D      COST81    .17            LD8       -1.                                  SEPV0076
    SEPCTRW   'MARKER'                 'SEPORG'                                       SEPV0077
    DL9A      COST91    4.23           LD9       -1.                                  SEPV0078
    DL9B      COST91    .17            LD9       -1.                                  SEPV0079
    DL9C      COST91    .06            LD9       -1.                                  SEPV0080
    DL9D      COST91    .17            LD9       -1.                                  SEPV0081
    SEPCTRR   'MARKER'                 'SEPORG'                                       SEPV0082
    DM7A      COST71    4.23           MD7       -1.                                  SEPV0083
    DM7B      COST71    .17            MD7       -1.                                  SEPV0084
    DM7C      COST71    .06            MD7       -1.                                  SEPV0085
    DM7D      COST71    .17            MD7       -1.                                  SEPV0086
    SEPCTRQ   'MARKER'                 'SEPORG'                                       SEPV0087
    DM8A      COST81    4.23           MD8       -1.                                  SEPV0088
    DM8B      COST81    .17            MD8       -1.                                  SEPV0089
    DM8C      COST81    .06            MD8       -1.                                  SEPV0090
    DM8D      COST81    .17            MD8       -1.                                  SEPV0091
    SEPCTRI   'MARKER'                 'SEPORG'                                       SEPV0092
    DM9A      COST91    4.23           MD9       -1.                                  SEPV0093
    DM9B      COST91    .17            MD9       -1.                                  SEPV0094
    DM9C      COST91    .06            MD9       -1.                                  SEPV0095
    DM9D      COST91    .17            MD9       -1.                                  SEPV0096
    SEPTRET   'MARKER'                 'SEPORG'                                       SEPV0097
    DN7A      COST71    4.40           ND7       -1.                                  SEPV0098
    DN7B      COST71    5.85           ND7       -1.                                  SEPV0099
    DN7C      COST71    3.93           ND7       -1.                                  SEPV0100
    SEPFFET   'MARKER'                 'SEPORG'                                       SEPV0101
    DN8A      COST81    4.40           ND8       -1.                                  SEPV0102
    DN8B      COST81    5.85           ND8       -1.                                  SEPV0103
    DN8C      COST81    3.93           ND8       -1.                                  SEPV0104
    SEPFFSV   'MARKER'                 'SEPORG'                                       SEPV0105
    DN9A      COST91    4.40           ND9       -1.                                  SEPV0106
    DN9B      COST91    5.85           ND9       -1.                                  SEPV0107
    DN9C      COST91    3.93           ND9       -1.                                  SEPV0108
    SEPFFSX   'MARKER'                 'SEPORG'                         SEPV0109
    DO7A      COST71      4.40         OD7        -1.                   SEPV0110
    DO7B      COST71      5.85         OD7        -1.                   SEPV0111
    DO7C      COST71      3.93         OD7        -1.                   SEPV0112
    SEPFFFI   'MARKER'                 'SEPORG'                         SEPV0113
    DO8A      COST81      4.40         OD8        -1.                   SEPV0114
    DO8B      COST81      5.85         OD8        -1.                   SEPV0115
    DO8C      COST81      3.93         OD8        -1.                   SEPV0116
    SEPFFFO   'MARKER'                 'SEPORG'                         SEPV0117
    DO9A      COST91      4.40         OD9        -1.                   SEPV0118
    DO9B      COST91      5.85         OD9        -1.                   SEPV0119
    DO9C      COST91      3.93         OD9        -1.                   SEPV0120
    SEPFFTW   'MARKER'                 'SEPORG'                         SEPV0121
    DP7A      COST71      4.40         PD7        -1.                   SEPV0122
    DP7B      COST71      5.85         PD7        -1.                   SEPV0123
    DP7C      COST71      3.93         PD7        -1.                   SEPV0124
    SEPFFTR   'MARKER'                 'SEPORG'                         SEPV0125
    DP8A      COST81      4.40         PD8        -1.                   SEPV0126
    DP8B      COST81      5.85         PD8        -1.                   SEPV0127
    DP8C      COST81      3.93         PD8        -1.                   SEPV0128
    SEPFFON   'MARKER'                 'SEPORG'                         SEPV0129
    DP9A      COST91      4.40         PD9        -1.                   SEPV0130
    DP9B      COST91      5.85         PD9        -1.                   SEPV0131
    DP9C      COST91      3.93         PD9        -1.                   SEPV0132
    SEPCTRX   'MARKER'                 'SEPORG'                         SEPV0133
    DQ7A      COST71      4.23         QD7        -1.                   SEPV0134
    DQ7B      COST71      .17          QD7        -1.                   SEPV0135
    DQ7C      COST71      .06          QD7        -1.                   SEPV0136
    DQ7D      COST71      .17          QD7        -1.                   SEPV0137
    SEPCTRV   'MARKER'                 'SEPORG'                         SEPV0138
    DQ8A      COST81      4.23         QD8        -1.                   SEPV0139
    DQ8B      COST81      .17          QD8        -1.                   SEPV0140
    DQ8C      COST81      .06          QD8        -1.                   SEPV0141
    DQ8D      COST81      .17          QD8        -1.                   SEPV0142
    SEPCTRE   'MARKER'                 'SEPORG'                         SEPV0143
    DQ9A      COST91      4.23         QD9        -1.                   SEPV0144
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DQ9B      COST91    .17            QD9      -1.                        SEPV0145
DQ9C      COST91    .06            QD9      -1.                        SEPV0146
DQ9D      COST91    .17            QD9      -1.                        SEPV0147
SEPTWO    'MARKER'                 'SEPORG'                            SEPV0148
DR7A      COST71    3.99           RD71     -1.                        SEPV0149
DR7B      COST71    1.40           RD71     -1.                        SEPV0150
SEPNMNY   'MARKER'                 'SEPORG'                            SEPV0151
DR8A      COST81    3.99           RD81     -1.                        SEPV0152
DR8B      COST81    1.40           RD81     -1.                        SEPV0153
SEPNINN   'MARKER'                 'SEPORG'                            SEPV0154
DR9A      COST91    3.99           RD91     -1.                        SEPV0155
DR9B      COST91    1.40           RD91     -1.                        SEPV0156
SEPTRSV   'MARKER'                 'SEPORG'                            SEPV0157
DS7A      COST71    4.23           SD7      -1.                        SEPV0158
DS7B      COST71    .17            SD7      -1.                        SEPV0159
DS7C      COST71    .06            SD7      -1.                        SEPV0160
DS7D      COST71    .17            SD7      -1.                        SEPV0161
SEPTHREE  'MARKER'                 'SEPORG'                            SEPV0162
DS8A      COST81    4.23           SD8      -1.                        SEPV0163
DS8B      COST81    .17            SD8      -1.                        SEPV0164
DS8C      COST81    .06            SD8      -1.                        SEPV0165
DS8D      COST81    .17            SD8      -1.                        SEPV0166
SEPONE    'MARKER'                 'SEPORG'                            SEPV0167
DS9A      COST91    4.23           SD9      -1.                        SEPV0168
DS9B      COST91    .17            SD9      -1.                        SEPV0169
DS9C      COST91    .06            SD9      -1.                        SEPV0170
DS9D      COST91    .17            SD9      -1.                        SEPV0171
SEPFRTR   'MARKER'                 'SEPORG'                            SEPV0172
DV7A      COST71    4.40           VD7      -1.                        SEPV0173
DV7B      COST71    5.85           VD7      -1.                        SEPV0174
DV7C      COST71    3.93           VD7      -1.                        SEPV0175
SEPFRFI   'MARKER'                 'SEPORG'                            SEPV0176
DV8A      COST81    4.40           VD8      -1.                        SEPV0177
DV8B      COST81    5.85           VD8      -1.                        SEPV0178
DV8C      COST81    3.93           VD8      -1.                        SEPV0179
SEPFRFR   'MARKER'                 'SEPORG'                            SEPV0180
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DV9A      COST91    4.40        VD9       -1.                        SEPV0181
DV9B      COST91    5.85        VD9       -1.                        SEPV0182
DV9C      COST91    3.93        VD9       -1.                        SEPV0183
SEPFRSX   'MARKER'              'SEPORG'                             SEPV0184
DW7A      COST71    4.40        WD7       -1.                        SEPV0185
DW7B      COST71    5.85        WD7       -1.                        SEPV0186
DW7C      COST71    3.93        WD7       -1.                        SEPV0187
SEPFRSV   'MARKER'              'SEPORG'                             SEPV0188
DW8A      COST81    4.40        WD8       -1.                        SEPV0189
DW8B      COST81    5.85        WD8       -1.                        SEPV0190
DW8C      COST81    3.93        WD8       -1.                        SEPV0191
SEPFFTY   'MARKER'              'SEPORG'                             SEPV0192
DW9A      COST91    4.40        WD9       -1.                        SEPV0193
DW9B      COST91    5.85        WD9       -1.                        SEPV0194
DW9C      COST91    3.93        WD9       -1.                        SEPV0195
SEPTEN    'MARKER'              'SEPORG'                             SEPV0196
WD7A      COST7     5.95        XD7       -1.                        SEPV0197
WD7B      COST7     1.64        XD7       -1.                        SEPV0198
WD7C      COST7     1.11        XD7       -1.                        SEPV0199
WD7D      COST7     .841        XD7       -1.                        SEPV0200
SEPELEVN  'MARKER'              'SEPORG'                             SEPV0201
WD8A      COST8     5.95        XD8       -1.                        SEPV0202
WD8B      COST8     1.64        XD8       -1.                        SEPV0203
WD8C      COST8     1.11        XD8       -1.                        SEPV0204
WD8D      COST8     .841        XD8       -1.                        SEPV0205
SEPTWLV   'MARKER'              'SEPORG'                             SEPV0206
WD9A      COST9     5.95        XD9       -1.                        SEPV0207
WD9B      COST9     1.64        XD9       -1.                        SEPV0208
WD9C      COST9     1.11        XD9       -1.                        SEPV0209
WD9D      COST9     .841        XD9       -1.                        SEPV0210
SEPNNNN   'MARKER'              'SEPORG'                             SEPV0211
WE7A      COST7     17.00       XE7       -1.                        SEPV0212
WE7B      COST7     3.670       XE7       -1.                        SEPV0213
WE7C      COST7     1.340       XE7       -1.                        SEPV0214
WE7D      COST7     .77         XE7       -1.                        SEPV0215
SEPSXSV   'MARKER'              'SEPORG'                             SEPV0216
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    WE8A      COST8     17.00          XE8       -1.                                     SEPV0217
    WE8B      COST8     3.670          XE8       -1.                                     SEPV0218
    WE8C      COST8     1.340          XE8       -1.                                     SEPV0219
    WE8D      COST8     .77            XE8       -1.                                     SEPV0220
    SEPSXET   'MARKER'                 'SEPORG'                                          SEPV0221
    WE9A      COST9     17.00          XE9       -1.                                     SEPV0222
    WE9B      COST9     3.670          XE9       -1.                                     SEPV0223
    WE9C      COST9     1.340          XE9       -1.                                     SEPV0224
    WE9D      COST9     .77            XE9       -1.                                     SEPV0225
    SEPSXNN   'MARKER'                 'SEPORG'                                          SEPV0226
    WF7A      COST7     17.00          XF7       -1.                                     SEPV0227
    WF7B      COST7     3.670          XF7       -1.                                     SEPV0228
    WF7C      COST7     1.340          XF7       -1.                                     SEPV0229
    WF7D      COST7     .77            XF7       -1.                                     SEPV0230
    SEPSVTY   'MARKER'                 'SEPORG'                                          SEPV0231
    WF8A      COST8     17.00          XF8       -1.                                     SEPV0232
    WF8B      COST8     3.670          XF8       -1.                                     SEPV0233
    WF8C      COST8     1.340          XF8       -1.                                     SEPV0234
    WF8D      COST8     .77            XF8       -1.                                     SEPV0235
    SEPSVON   'MARKER'                 'SEPORG'                                          SEPV0236
    WF9A      COST9     17.00          XF9       -1.                                     SEPV0237
    WF9B      COST9     3.670          XF9       -1.                                     SEPV0238
    WF9C      COST9     1.340          XF9       -1.                                     SEPV0239
    WF9D      COST9     .77            XF9       -1.                                     SEPV0240
    SEPCTRE   'MARKER'                 'SEPORG'                                          SEPV0241
    WG7A      COST7     5.95           XG7       -1.                                     SEPV0242
    WG7B      COST7     1.64           XG7       -1.                                     SEPV0243
    WG7C      COST7     1.11           XG7       -1.                                     SEPV0244
    WG7D      COST7     .841           XG7       -1.                                     SEPV0245
    SEPTWTR   'MARKER'                 'SEPORG'                                          SEPV0246
    WG8A      COST8     5.95           XG8       -1.                                     SEPV0247
    WG8B      COST8     1.64           XG8       -1.                                     SEPV0248
    WG8C      COST8     1.11           XG8       -1.                                     SEPV0249
    WG8D      COST8     .841           XG8       -1.                                     SEPV0250
    SEPTWFO   'MARKER'                 'SEPORG'                                          SEPV0251
    WG9A      COST9     5.95           XG9       -1.                                     SEPV0252
    WG9B      COST9     1.64           XG9       -1.                    SEPV0253
    WG9C      COST9     1.11           XG9       -1.                    SEPV0254
    WG9D      COST9     .841           XG9       -1.                    SEPV0255
    SEPCSIX   'MARKER'                 'SEPORG'                         SEPV0256
    WI7A      COST7     17.00          XI7       -1.                    SEPV0257
    WI7B      COST7     3.670          XI7       -1.                    SEPV0258
    WI7C      COST7     1.340          XI7       -1.                    SEPV0259
    WI7D      COST7     .77            XI7       -1.                    SEPV0260
    SEP>VTR   'MARKER'                 'SEPORG'                         SEPV0261
    WI8A      COST8     17.00          XI8       -1.                    SEPV0262
    WI8B      COST8     3.670          XI8       -1.                    SEPV0263
    WI8C      COST8     1.340          XI8       -1.                    SEPV0264
    WI8D      COST8     .77            XI8       -1.                    SEPV0265
    SEPSVFR   'MARKER'                 'SEPORG'                         SEPV0266
    WI9A      COST9     17.00          XI9       -1.                    SEPV0267
    WI9B      COST9     3.670          XI9       -1.                    SEPV0268
    WI9C      COST9     1.340          XI9       -1.                    SEPV0269
    WI9D      COST9     .77            XI9       -1.                    SEPV0270
    SEPTWFI   'MARKER'                 'SEPORG'                         SEPV0271
    WL7A      COST7     5.95           XL7       -1.                    SEPV0272
    WL7B      COST7     1.64           XL7       -1.                    SEPV0273
    WL7C      COST7     1.11           XL7       -1.                    SEPV0274
    WL7D      COST7     .841           XL7       -1.                    SEPV0275
    SEPTWSX   'MARKER'                 'SEPORG'                         SEPV0276
    WL8A      COST8     5.95           XL8       -1.                    SEPV0277
    WL8B      COST8     1.64           XL8       -1.                    SEPV0278
    WL8C      COST8     1.11           XL8       -1.                    SEPV0279
    WL8D      COST8     .841           XL8       -1.                    SEPV0280
    SEPTWSV   'MARKER'                 'SEPORG'                         SEPV0281
    WL9A      COST9     5.95           XL9       -1.                    SEPV0282
    WL9B      COST9     1.64           XL9       -1.                    SEPV0283
    WL9C      COST9     1.11           XL9       -1.                    SEPV0284
    WL9D      COST9     .841           XL9       -1.                    SEPV0285
    SEPTWET   'MARKER'                 'SEPORG'                         SEPV0286
    WM7A      COST7     5.95           XM7       -1.                    SEPV0287
    WM7B      COST7     1.64           XM7       -1.                    SEPV0288
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WM7C      COST7     1.11            XM7       -1.                           SEPV0289
WM7D      COST7     .841            XM7       -1.                           SEPV0290
SEPTWNN   'MARKER'                  'SEPORG'                                SEPV0291
WM8A      COST8     5.95            XM8       -1.                           SEPV0292
WM8B      COST8     1.64            XM8       -1.                           SEPV0293
WM8C      COST8     1.11            XM8       -1.                           SEPV0294
WM8D      COST8     .841            XM8       -1.                           SEPV0295
SEPNNET   'MARKER'                  'SEPORG'                                SEPV0296
WM9A      COST9     5.95            XM9       -1.                           SEPV0297
WM9B      COST9     1.64            XM9       -1.                           SEPV0298
WM9C      COST9     1.11            XM9       -1.                           SEPV0299
WM9D      COST9     .841            XM9       -1.                           SEPV0300
SEPSVFI   'MARKER'                  'SEPORG'                                SEPV0301
WN7A      COST7     17.00           XN7       -1.                           SEPV0302
WN7B      COST7     3.670           XN7       -1.                           SEPV0303
WN7C      COST7     1.340           XN7       -1.                           SEPV0304
WN7D      COST7     .77             XN7       -1.                           SEPV0305
SEPSVSX   'MARKER'                  'SEPORG'                                SEPV0306
WN8A      COST8     17.00           XN8       -1.                           SEPV0307
WN8B      COST8     3.670           XN8       -1.                           SEPV0308
WN8C      COST8     1.340           XN8       -1.                           SEPV0309
WN8D      COST8     .77             XN8       -1.                           SEPV0310
SEPSVSV   'MARKER'                  'SEPORG'                                SEPV0311
WN9A      COST9     17.00           XN9       -1.                           SEPV0312
WN9B      COST9     3.670           XN9       -1.                           SEPV0313
WN9C      COST9     1.340           XN9       -1.                           SEPV0314
WN9D      COST9     .77             XN9       -1.                           SEPV0315
SEPSVNN   'MARKER'                  'SEPORG'                                SEPV0316
WO7A      COST7     17.00           XO7       -1.                           SEPV0317
WO7B      COST7     3.670           XO7       -1.                           SEPV0318
WO7C      COST7     1.340           XO7       -1.                           SEPV0319
WO7D      COST7     .77             XO7       -1.                           SEPV0320
SEPETTW   'MARKER'                  'SEPORG'                                SEPV0321
WO8A      COST8     17.00           XO8       -1.                           SEPV0322
WO8B      COST8     3.670           XO8       -1.                           SEPV0323
WO8C      COST8     1.340           XO8       -1.                           SEPV0324
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WO8D      COST8     .77        XO8       -1.            SEPV0325
SEPETYY   'MARKER'             'SEPORG'                 SEPV0326
WO9A      COST9     17.00      XO9       -1.            SEPV0327
WO9B      COST9     3.670      XO9       -1.            SEPV0328
WO9C      COST9     1.340      XO9       -1.            SEPV0329
WO9D      COST9     .77        XO9       -1.            SEPV0330
SEPETON   'MARKER'             'SEPORG'                 SEPV0331
WP7A      COST7     17.00      XP7       -1.            SEPV0332
WP7B      COST7     3.670      XP7       -1.            SEPV0333
WP7C      COST7     1.340      XP7       -1.            SEPV0334
WP7D      COST7     .77        XP7       -1.            SEPV0335
SEPETTR   'MARKER'             'SEPORG'                 SEPV0336
WP8A      COST8     17.00      XP8       -1.            SEPV0337
WP8B      COST8     3.670      XP8       -1.            SEPV0338
WP8C      COST8     1.340      XP8       -1.            SEPV0339
WP8D      COST8     .77        XP8       -1.            SEPV0340
SEPETFO   'MARKER'             'SEPORG'                 SEPV0341
WP9A      COST9     17.00      XP9       -1.            SEPV0342
WP9B      COST9     3.670      XP9       -1.            SEPV0343
WP9C      COST9     1.340      XP9       -1.            SEPV0344
WP9D      COST9     .77        XP9       -1.            SEPV0345
SEPCNNN   'MARKER'             'SEPORG'                 SEPV0346
WQ7A      COST7     5.95       XQ7       -1.            SEPV0347
WQ7B      COST7     1.64       XQ7       -1.            SEPV0348
WQ7C      COST7     1.11       XQ7       -1.            SEPV0349
WQ7D      COST7     .841       XQ7       -1.            SEP/0350
SEPNNSX   'MARKER'             'SEPORG'                 SEPV0351
WQ8A      COST8     5.95       XQ8       -1.            SEPV0352
WQ8B      COST8     1.64       XQ8       -1.            SEPV0353
WQ8C      COST8     1.11       XQ8       -1.            SEPV0354
WQ8D      COST8     .841       XQ8       -1.            SEPV0355
SEPITYV   'MARKER'             'SEPORG'                 SEPV0356
WQ9A      COST9     5.95       XQ9       -1.            SEPV0357
WQ9B      COST9     1.64       XQ9       -1.            SEPV0358
WQ9C      COST9     1.11       XQ9       -1.            SEPV0359
WQ9D      COST9     .841       XQ9       -1.            SEPV0360
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    SEPFRON   'MARKER'                 'SEPORG'                              SEPV0361
    WR7A      COST7        3.52        XR7            -1.                    SEPV0362
    WR7B      COST7        .85         XR7            -1.                    SEPV0363
    WR7C      COST7        .31         XR7            -1.                    SEPV0364
    WR7D      COST7        .14         XR7            -1.                    SEPV0365
    SEPCELE   'MARKER'                 'SEPORG'                              SEPV0366
    WR8A      COST8        3.52        XR8            -1.                    SEPV0367
    WR8B      COST8        .85         XR8            -1.                    SEPV0368
    WR8C      COST8        .31         XR8            -1.                    SEPV0369
    WR8D      COST8        .14         XR8            -1.                    SEPV0370
    SEPCTEN   'MARKER'                 'SEPORG'                              SEPV0371
    WR9A      COST9        3.52        XR9            -1.                    SEPV0372
    WR9B      COST9        .85         XR9            -1.                    SEPV0373
    WR9C      COST9        .31         XR9            -1.                    SEPV0374
    WR9D      COST9        .14         XR9            -1.                    SEPV0375
    SEPFRTY   'MARKER'                 'SEPORG'                              SEPV0376
    WS7A      COST7        5.95        XS7            -1.                    SEPV0377
    WS7B      COST7        1.64        XS7            -1.                    SEPV0378
    WS7C      COST7        1.11        XS7            -1.                    SEPV0379
    WS7D      COST7        .841        XS7            -1.                    SEPV0380
    SEPTRNN   'MARKER'                 'SEPORG'                              SEPV0381
    WS8A      COST8        5.95        XS8            -1.                    SEPV0382
    WS8B      COST8        1.64        XS8            -1.                    SEPV0383
    WS8C      COST8        1.11        XS8            -1.                    SEPV0384
    WS8D      COST8        .841        XS8            -1.                    SEPV0385
    SEPSIXN   'MARKER'                 'SEPORG'                              SEPV0386
    WS9A      COST9        5.95        XS9            -1.                    SEPV0387
    WS9B      COST9        1.64        XS9            -1.                    SEPV0388
    WS9C      COST9        1.11        XS9            -1.                    SEPV0389
    WS9D      COST9        .841        XS9            -1.                    SEPV0390
    SEPETFI   'MARKER'                 'SEPORG'                              SEPV0391
    WV7A      COST7        17.00       XV7            -1.                    SEPV0392
    WV7B      COST7        3.670       XV7            -1.                    SEPV0393
    WV7C      COST7        1.340       XV7            -1.                    SEPV0394
    WV7D      COST7        .77         XV7            -1.                    SEPV0395
    SEPFRET   'MARKER'                 'SEPORG'                              SEPV0396
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WV8A      COST8     17.00          XV8       -1.                   SEPV0397
WV8B      COST8     3.670          XV8       -1.                   SEPV0398
WV8C      COST8     1.340          XV8       -1.                   SEPV0399
WV8D      COST8     .77            XV8       -1.                   SEPV0400
SEPCTWE   'MARKER'                 'SEPORG'                        SEPV0401
WV9A      COST9     17.00          XV9       -1.                   SEPV0402
WV9B      COST9     3.670          XV9       -1.                   SEPV0403
WV9C      COST9     1.340          XV9       -1.                   SEPV0404
WV9D      COST9     .77            XV9       -1.                   SEPV0405
SEPCTRN   'MARKER'                 'SEPORG'                        SEPV0406
WW7A      COST7     17.00          XW7       -1.                   SEPV0407
WW7B      COST7     3.670          XW7       -1.                   SEPV0408
WW7C      COST7     1.340          XW7       -1.                   SEPV0409
WW7D      COST7     .77            XW7       -1.                   SEPV0410
SEPCFRN   'MARKER'                 'SEPORG'                        SEPV0411
WW8A      COST8     17.00          XW8       -1.                   SEPV0412
WW8B      COST8     3.670          XW8       -1.                   SEPV0413
WW8C      COST8     1.340          XW8       -1.                   SEPV0414
WW8D      COST8     .77            XW8       -1.                   SEPV0415
SEPCFIN   'MARKER'                 'SEPORG'                        SEPV0416
WW9A      COST9     17.00          XW9       -1.                   SEPV0417
WW9B      COST9     3.670          XW9       -1.                   SEPV0418
WW9C      COST9     1.340          XW9       -1.                   SEPV0419
WW9D      COST9     .77            XW9       -1.                   SEPV0420
SEPEND    'MARKER'                 'SEPEND'                        SEPV0421
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RHS                                                                            RHS 0001
    WASTE     EQ        23499999.                                              RHS 0002
    WASTE     FV        60000.         FP        38000.                        RHS 0003
    WASTE     FF        48000.         FE        56000.                        RHS 0004
    WASTE     FW        24000.         FN        30000.                        RHS 0005
    WASTE     FC        94000.                                                 RHS 0006
    WASTE     GB7       1050000.       GB8       1210000.                      RHS 0007
    WASTE     GB9       1340000.       GC7       1300000.                      RHS 0008
    WASTE     GC8       1480000.       GC9       1630000.                      RHS 0009
    WASTE     GD7       1960000.       GD8       2300000.                      RHS 0010
    WASTE     GD9       2520000.       GE7       1790000.                      RHS 0011
    WASTE     GE8       2170000.       GE9       2480000.                      RHS 0012
    WASTE     GF7       960000.        GF8       1190000.                      RHS 0013
    WASTE     GF9       1300000.       GH7       650000.                       RHS 0014
    WASTE     GH8       1000000.       GH9       1390000.                      RHS 0015
    WASTE     GL7       520000.        GL8       710000.                       RHS 0016
    WASTE     GL9       850000.        GM7       470000.                       RHS 0017
    WASTE     GM8       560000.        GM9       680000.                       RHS 0018
    WASTE     GP9       1000000.                                               RHS 0019
    WASTE     GP7       570000.        GP8       770000.                       RHS 0020
    WASTE     GN7       600000.        GN8       730000.                       RHS 0021
    WASTE     GN9       830000.        GQ7       770000.                       RHS 0022
    WASTE     GQ8       970000.        GQ9       1170000.                      RHS 0023
    WASTE     GR7       770000.        GR8       1070000.                      RHS 0024
    WASTE     GR9       1170000.       GS7       990000.                       RHS 0025
    WASTE     GS8       1230000.       GS9       1470000.                      RHS 0026
    WASTE     GT7       480000.        GT8       560000.                       RHS 0027
    WASTE     GT9       620000.        GW7       870000.                       RHS 0028
    WASTE     GW8       1030000.       GW9       1160000.                      RHS 0029
    WASTE     GY7       900000.        GY8       1150000.                      RHS 0030
    WASTE     GY9       1510000.                                               RHS 0031
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 UP SEPBOUND  DE7B     726000.                                          BNDS0012
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 UP SEPBOUND  WW8C       2275000.                                          BNDS0238
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ENDATA                                                                     BNDS0242
/*                                                                         BNDS0243
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## X. The Brookline Solid Waste Ordinance

The following copy of Brookline's laws governing refuse collection is included for reference:

I. Name of Ordinance

Regulations Governing the Handling, Storage, Collection and Disposal of Waste, August 31, 1967.

II. General Statement

Definitions

a. Domestic Waste includes garbage and rubbish resulting from the usual routine of housekeeping.
b. Commercial Waste includes garbage and rubbish material resulting from the operation of business enterprises. Manufacturing and trade wastes are not included.
c. Municipal Waste includes domestic waste and commercial waste.
d. Garbage includes all waste -- animal, fish, fowl, fruit or vegetable matter incident to the use, preparation and storage of food, including containers except glassware, and/or wrappings contaminated with such organic (putrescible) material.
e. Rubbish includes waste resulting from housekeeping and ordinary mercantile enterprises, such as packing boxes, cartons, excelsior, paper, ashes, cinders, tin cans, bottles and metals, and similar material.
f. Burnable Rubbish includes all domestic or commercial waste not acceptable for incineration. This includes ashes, cinders, glassware, earthenware, tin ware, bed springs, auto parts and other metallic substances, and containers for paint, gasoline, solvents, cleaning fluids and other explosive materials, including aerosol and similar type containers, and especially light bulbs, television tubes and fluorescent tubes.
g. Tree waste includes tree stumps, trunks or limbs, three (3) inches or more in diameter or three (3) feet or more in length; tree waste is not clsssified as municipal waste (section 1).

III. Administration

1. Responsible Agency
   a. Sanitation Division of Department of Public Works
   b. Director of Public Health
2. Functions and Powers
   a. Department of Public Works

(1) To collect domestic waste (section 2B).
(2) To establish standards for storage (section 2B).
(3) To establish time and place for collection (section 2C1)
(4) To collect commercial waste (if not otherwise collected.) (section 3A).
(5) To approve any suitable device for storage, handling, and disposal of waste (section 5).
(6) To set fees for collection and disposal (section 6).

b. Director of Public Health
(1) To issue permits for private dumps (section 8A).
(2) To inspect private dumps (section 8B).
(3) To revoke or suspend permits for private dumps (section 8C).
(4) To issue permits for private collection (section 9A).
(5) To revoke or suspend permits for private collection (section 9A).
(6) To order removal of any accumulation which becomes a nuisance (section 7C).

## IV. Scope of Legislation

### 1. Standards and Regulation

a. Storage of Domestic Waste (sections 2A and B)
(1) Owner or occupant shall provide, and keep clean and in good repair a sufficient number of containers.
(2) Burnable and non-burnable rubbish shall be separated and placed in separate containers.
(3) Burnable rubbish or garbage may be stored separately or together.
(4) Garbage shall be drained of all liquid and wrapped.
(5) Containers shall be watertight, have tight fitting covers, have substantial handles, not exceed 26 gallons in capacity and 100 pounds in weight, when full.
(6) Bundles shall be securely tied and not exceed 75 pounds in weight or 3 feet in maximun dimension.
(7) Containers for burnable rubbish shall be similar to containers for non-burnable rubbish except that there shall be a 3" wide green strip painted around the center.
(8) Tree branches, shrubbery, and vines shall be tied in standard bundles and cut grass and leaves shall be stored in suitable containers. They shall be placed for collection with non-burnable rubbish.

b. Storage of Commercial Waste

(1) The owner of the business shall provide a sufficient number of containers.
(2) Commercial garbage shall be separated in the same fashion as domestic waste (sections 3A and B).

c. Collection of Domestic Waste

(1) All rubbish and mixed garbage shall be collected from curb and separately stored garbage from the yard.
(2) All rubbish and mixed garbage containers shall be placed at curb and removed after collection.
(3) Improperly stored or bulky items may be refused collection and the Sanitary Division shall attach reasons therefore if practicable (section 2C).

d. Collection of Commercial Waste

Shall be collected by Sanitation Division, private collector, or owner of business at regular intervals to prevent a nuisance (section 3A).

e. Collection of other Waste

(1) All small dead animals, except those from animal hospitals and kennels, will be collected upon notice.
(2) Tree waste, construction waste, and trade waste must be deposited by owner of premises.
(3) Incinerator waste shall be placed in containers for burnable rubbish.
(4) All hospital waste shall be placed in cardboard box, then sealed and labeled (section 4).

f. Transportation of Wastes

Vehicles must be so constructed as to prevent spillange and blowing away of contents (section 9C).

2. Prohibited Activities

a. It shall be unlawful to deposit any garbage, rubbish, or other waste upon the street, park, or any premises, except an approved disposal area in containers as required by these regulation.

b. It shall be unlawful to scavenge in containers set out for collection or articles delivered to landfill or incinerator (section 6).

## V. Enforcement

### 1. Requirements for Permits

a. Private Dumps
  - (1) A permit is required for use of public or private premises as disposal area.
  - (2) A permit is to be granted by the Director of Public Health if he feels the area will not be a nuisance, be unsightly or be a violation of zoning laws. A permit may be granted subject to such conditions as the Director feels are necessary. (section 8).

b. Private Collectors
  - (1) Permits are required to transport wastes through the town except that the Sanitation Division and originator of the wastes do not need a permit.
  - (2) Applications are to be made to the Director of Public Health.
  - (3) Permits shall expire at end of each calendar year but may be renewed annually (section 9).

### 2. Inspection Procedure

Director of Public Health may inspect proposed private dump (section 8B).

### 3. Liability for Violaters

a. The Director of Public Health may revoke or syspend a permit for a dump if the dump becomes a nuisance (section 8C).
b. The Director of Public Health may revoke or suspend a permit for private collection if this ordinance is not complied with.

### 4. Penalties

A fine not to exceed $20 for violation of sections 2-7 of the regulation and a fine not to exceed $50 shall be possible for violation of sections 8 or 9 of these regulation (section 10B).

FROM: M.D. Powell, B.P. Fiedelman, and M.J. Roe. Digest of Selected Local Solid Waste Management Ordinances. Washington: U.S. Government Printing Office, 1972.

## References

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2. *Mathematical Programming System -- Extended (MPSX), and Generalized Upper Bounding (GUB) Program Description. (SH20-0968-1)*. IBM Technical Publications Department, 1972.

3. *Introduction to Mathematical Programming System -- Extended (MPSX). (GH20-0849-1).* White Plains: IBM Technical Publications Department, 1971.